PRIME / TUF GAMING Intel® 500 Series

BIOS Manual

Motherboard

Contents

1   Knowing BIOS

The new ASUS UEFI BIOS is a Unified Extensible Interface that complies with UEFI architecture, offering a user-friendly interface that goes beyond the traditional keyboard-only BIOS controls to enable a more flexible and convenient mouse input. You can easily navigate the new UEFI BIOS with the same smoothness as your operating system. The term "BIOS" in this user manual refers to "UEFI BIOS" unless otherwise specified.

BIOS (Basic Input and Output System) stores system hardware settings such as storage device configuration, overclocking settings, advanced power management, and boot device configuration that are needed for system startup in the motherboard CMOS. In normal circumstances, the default BIOS settings apply to most conditions to ensure optimal performance. **DO NOT change the default BIOS settings** except in the following circumstances:

- An error message appears on the screen during the system bootup and requests you to run the BIOS Setup.

- You have installed a new system component that requires further BIOS settings or update.

Inappropriate BIOS settings may result to instability or boot failure. **We strongly recommend that you change the BIOS settings only with the help of a trained service personnel**.

BIOS settings and options may vary due to different BIOS release versions. Please refer to the latest BIOS version for settings and options.

2 BIOS Setup program

Use the BIOS Setup to update the BIOS or configure its parameters. The BIOS screens include navigation keys and brief onscreen help to guide you in using the BIOS Setup program.

Entering BIOS at startup

To enter BIOS Setup at startup, press <Delete> or <F2> during the Power-On Self Test (POST). If you do not press <Delete> or <F2>, POST continues with its routines.

Entering BIOS Setup after POST

To enter BIOS Setup after POST:

- Press <Ctrl>+<Alt>+<Delete> simultaneously.

- Press the reset button on the system chassis.

- Press the power button to turn the system off then back on. Do this option only if you failed to enter BIOS Setup using the first two options.

After doing either of the three options, press <Delete> key to enter BIOS.

- The BIOS Setup screens shown in this section are for reference purposes only, and may not exactly match what you see on your screen.

- Ensure that a USB mouse is connected to your motherboard if you want to use the mouse to control the BIOS Setup program.

- If the system becomes unstable after changing any BIOS setting, load the default settings to ensure system compatibility and stability. Select the **Load Optimized Defaults** item under the **Exit** menu or press hotkey **<F5>**. See chapter **11 Exit menu** for details.

- If the system fails to boot after changing any BIOS setting, try to clear the CMOS and reset the motherboard to the default value. See your motherboard manual for information on how to erase the RTC RAM.

- The BIOS Setup program does not support Bluetooth devices.

BIOS menu screen

The BIOS Setup program can be used under two modes: **EZ Mode** and **Advanced Mode**. You can change modes from **Setup Mode** in the **Boot** menu or by pressing the <F7> hotkey.

2.1 EZ Mode

The EZ Mode provides you an overview of the basic system information, and allows you to select the display language, system performance, mode and boot device priority. To access the Advanced Mode, click **Advanced Mode(F7)** or press the <F7> hotkey for the advanced BIOS settings.

> The default screen for entering the BIOS Setup program can be changed. Refer to the **Setup Mode** item in the **8.3 Boot Configuration** section for details.

Displays the CPU/motherboard temperature, CPU voltage output, CPU/chassis/power fan speed, and SATA information

Selects the display language of the BIOS Setup program

Searches by BIOS item name, enter the item name to find the related item listing

Displays the system properties of the selected mode. Click < or > to switch EZ System Tuning modes

Turns the RGB LED lighting or functional LED on or off

Turns the Re-Size BAR Support on or off

UEFI BIOS Utility — EZ Mode
01/19/2021 Tuesday 12:53 | English | Search(F9) | AURA(F4) | ReSize BAR

Information
TUF GAMING Z590-PLUS WIFI   BIOS Ver. 0405
Intel(R) Core(TM) i5-10400 CPU @ 2.90GHz
Speed: 2900 MHz
Memory: 8192 MB (DDR4 2133MHz)

CPU Temperature
49°C

CPU Core Voltage
0.879 V

Motherboard Temperature
29°C

DRAM Status
DIMM_A1: N/A
DIMM_A2: Samsung 8192MB 2133MHz
DIMM_B1: N/A
DIMM_B2: N/A

Storage Information
USB:
Generic-SD/MMC (16.1GB)

EZ System Tuning
Click the icon below to enable the AI Overclocking feature. This feature can only be enabled when using an unlocked CPU.

Normal

X.M.P.
Disabled   Disabled

Boot Priority
Choose one and drag the items.   Switch all

UEFI: Generic-SD/MMC, Partition 1 (16.1GB)

Generic-SD/MMC (16.1GB)

FAN Profile
CPU FAN 1864 RPM
CPU OPT FAN N/A
CHA1 FAN N/A
CHA2 FAN N/A
CHA3 FAN N/A
AIO PUMP N/A

CPU FAN
%
100
50
0   30   70   100   °C

QFan Control

Boot Menu(F8)

Default(F5)   Save & Exit(F10)   Advanced Mode(F7)

Displays the CPU Fan's speed. Click the button to manually tune the fans

Loads optimized default settings

Saves the changes and resets the system

Click to go to Advanced mode

Click to display boot devices

Selects the boot device priority

> The boot device options vary depending on the devices you installed to the system.

2.2 Advanced Mode

The Advanced Mode provides advanced options for experienced end-users to configure the BIOS settings. The figure below shows an example of the Advanced Mode. Refer to the following sections for the detailed configurations.

> To switch from EZ Mode to Advanced Mode, click **Advanced Mode(F7)** or press the <F7> hotkey.

Configuration fields

Language   **Qfan Control(F6)**   **AURA(F4)**   **Scroll bar**

Menu bar   **MyFavorite(F3)**   **Search(F9)**   **ReSize BAR**

UEFI BIOS Utility — Advanced Mode

01/19/2021 Tuesday 14:12

⊕ English ⊟ MyFavorite(F3) 🔧 Qfan Control(F6) ? Search(F9) AURA(F4) ReSize BAR

My Favorites   Main   Ai Tweaker   Advanced   Monitor   Boot   Tool   Exit

Ai Overclock Tuner — Auto

ASUS MultiCore Enhancement — Auto – Lets BIOS Optimize

Current ASUS MultiCore Enhancement Status — Enabled

SVID Behavior — Auto

CPU Core Ratio — Auto

DRAM Odd Ratio Mode — Enabled

DRAM Frequency — Auto

OC Tuner — Keep Current Settings

Keep Current Settings
OC Tuner I
OC Tuner II

▶ DRAM Timing Control
▶ DIGI+ VRM
▶ Internal CPU Power Management
▶ Thermal Velocity Boost

ⓘ OC Tuner automatically overlocks the CPU or DRAM frequencies and voltage for an enhanced system performance depending on the DRAM type and an accelerated iGPU performance depending on the iGPU loading. Install an efficient CPU fan for OC Tuner I or Tuner II mode selection.

Hardware Monitor

CPU
Frequency 2900 MHz   Temperature 50°C
BCLK 100.00 MHz   Core Voltage 0.870 V
Ratio 29x

Memory
Frequency 2133 MHz   Voltage 1.200 V
Capacity 8192 MB

Voltage
+12V 12.000 V   +5V 5.120 V
+3.3V 3.312 V

Last Modified   EzMode(F7)   Hot Keys

Version 2.21.1278 Copyright (C) 2021 AMI

Submenu items   **Pop-up Menu**   **Last modified settings**   **Go back to EZ Mode**   **Hot keys**

Menu items   **General help**

Displays a quick overview of the system status

Menu bar

The menu bar on top of the screen has the following main items:

My Favorites	For saving the frequently-used system settings and configuration.
Main	For changing the basic system configuration
Ai Tweaker	For changing the overclocking settings
Advanced	For changing the advanced system settings
Monitor	For displaying the system temperature, power status, and changing the fan settings.
Boot	For changing the system boot configuration
Tool	For configuring options for special functions
Exit	For selecting the exit options and loading default settings

Menu items

The highlighted item on the menu bar displays the specific items for that menu. For example, selecting **Main** shows the Main menu items.

The other items (**My Favorites**, **Ai Tweaker**, **Advanced**, **Monitor**, **Boot**, **Tool**, and **Exit**) on the menu bar have their respective menu items.

Submenu items

An arrow sign (>) before each item on any menu screen means that the item has a submenu. To display the submenu, select the item and press <Enter>.

Language

This button above the menu bar contains the languages that you can select for your BIOS. Click this button to select the language that you wish to display in your BIOS screens.

MyFavorite(F3)

This button above the menu bar shows all BIOS items in a Setup Tree Map. Select frequently-used BIOS settings and save it to My Favorites menu.

> Refer to the chapter **4 My Favorites menu** for more information.

Qfan Control(F6)

This button above the menu bar displays the current settings of your fans. Use this button to manually tweak the fans to your desired settings.

> Refer to the chapter **3 Q-Fan Control** for more information.

Search(F9)

This button allows you to search for BIOS items by entering its name, enter the item name to find the related item listing.

AURA(F4)

This button allows you to turn the RGB LED lighting or functional LED on or off.

[All On]   All LEDs (Aura or Functional) will be enabled.

[Stealth Mode]   All LEDs (Aura and Functional) will be disabled.

[Aura Only]   Aura LEDs will be enabled and functional LEDs will be disabled.

[Aura Off]   Aura LEDs will be disabled, however functional LEDs will still be enabled.

ReSize BAR

This button allows you to enable or disable the Re-Size BAR Support.

[OFF]   Re-Size BAR Support will be disabled.

[ON]   Enable Re-Size BAR Support for harnessing full GPU memory, and CSM
                    (Compatibility Support Module) will be disabled.

Scroll bar

A scroll bar appears on the right side of a menu screen when there are items that do not fit on the screen. Press the Up/Down arrow keys or <Page Up> / <Page Down> keys to display the other items on the screen.

General help

At the bottom of the menu screen is a brief description of the selected item. Use <F12> key to capture the BIOS screen and save it to the removable storage device.

Configuration fields

These fields show the values for the menu items. If an item is user-configurable, you can change the value of the field opposite the item. You cannot select an item that is not user-configurable.

A configurable field is highlighted when selected. To change the value of a field, select it and press <Enter> to display a list of options.

Last Modified button

This button shows the items that you last modified and saved in BIOS Setup.
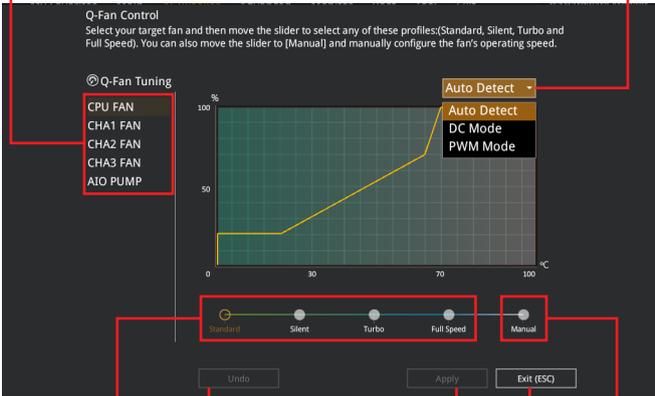
Hot keys

This button above the menu bar contains the navigation keys for the BIOS Setup program. Use the navigation keys to select items in the menu and change the settings.

3   Q-Fan Control

The Q-Fan Control allows you to set a fan profile or manually configure the operating speed of your CPU and chassis fans. Click **Qfan Control(F6)** or press the <F6> hotkey for the Q-Fan settings.

Click to select a fan to be configured
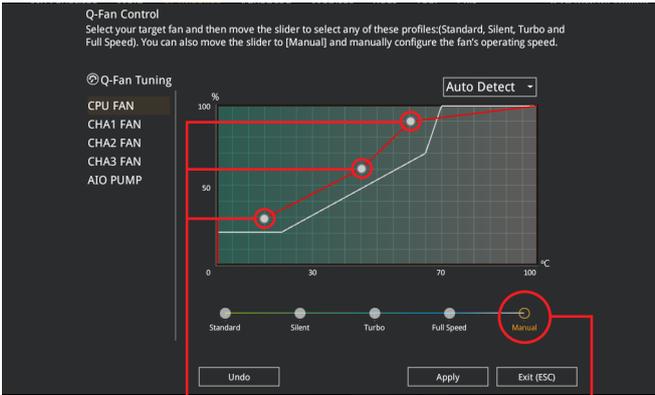
Select a mode to apply to your fan

Q-Fan Control
Select your target fan and then move the slider to select any of these profiles:(Standard, Silent, Turbo and Full Speed). You can also move the slider to [Manual] and manually configure the fan's operating speed.

Q-Fan Tuning

CPU FAN
CHA1 FAN
CHA2 FAN
CHA3 FAN
AIO PUMP

Auto Detect
Auto Detect
DC Mode
PWM Mode

Standard   Silent   Turbo   Full Speed   Manual

Undo   Apply   Exit (ESC)

Select a profile to apply to your fan

Click to apply the fan setting

Click to go back to main menu

Click to undo the changes

Select to manually configure your fans

Configuring fans manually

Select **Manual** from the list of profiles to manually configure your fans' operating speed.

Q-Fan Control
Select your target fan and then move the slider to select any of these profiles:(Standard, Silent, Turbo and Full Speed). You can also move the slider to [Manual] and manually configure the fan's operating speed.

Q-Fan Tuning

CPU FAN
CHA1 FAN
CHA2 FAN
CHA3 FAN
AIO PUMP

Auto Detect

Standard   Silent   Turbo   Full Speed   Manual

Undo   Apply   Exit (ESC)

Speed points

Select to manually configure your fans

To configure your fans:

1.   Select the fan that you want to configure and to view its current status.

2.   Click and drag the speed points to adjust the fans' operating speed.

3.   Click **Apply** to save the changes, then click **Exit (ESC)**.
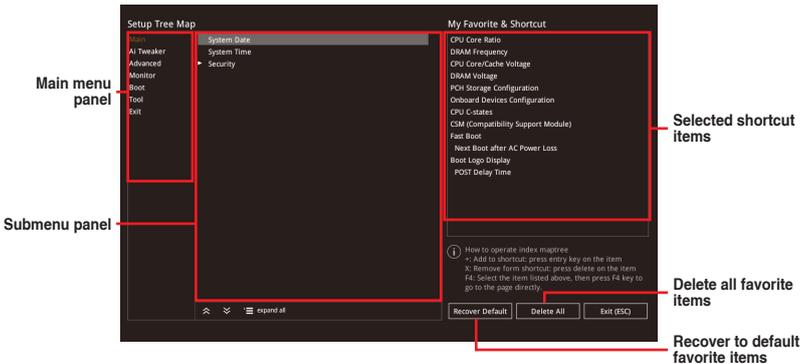
4   My Favorites menu

My Favorites is your personal space where you can easily save and access your favorite
BIOS items. You can personalize this screen by adding or removing items.
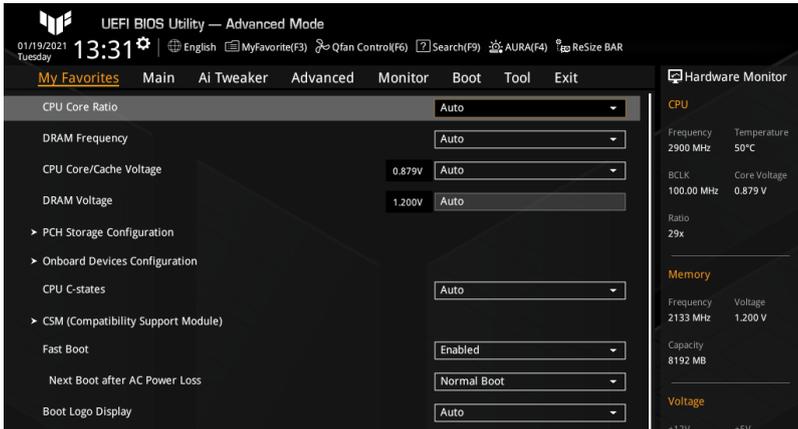
Adding items to My Favorites

To add BIOS items:

1.   Press <F3> on your keyboard or click **MyFavorite(F3)** from the BIOS screen to open
        Setup Tree Map screen.

2.   On the Setup Tree Map screen, select the BIOS items that you want to save in the My
        Favorites screen.

3.   Select an item from main menu panel, then click the submenu that you want to save as
        favorite from the submenu panel and click ➕ or press <Enter> on your keyboard.

4.   Click **Exit (ESC)** or press <Esc> key to close Setup Tree Map screen.

5.   Go to **My Favorites** menu to view the saved BIOS items.

5   Main menu

The Main menu screen appears when you enter the Advanced Mode of the BIOS Setup program. The Main menu provides you an overview of the basic system information, and allows you to set the system language, date, time, and security settings.
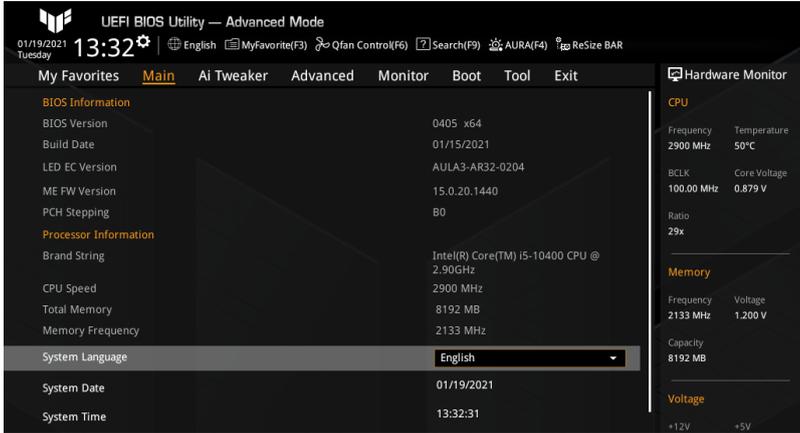
System Language

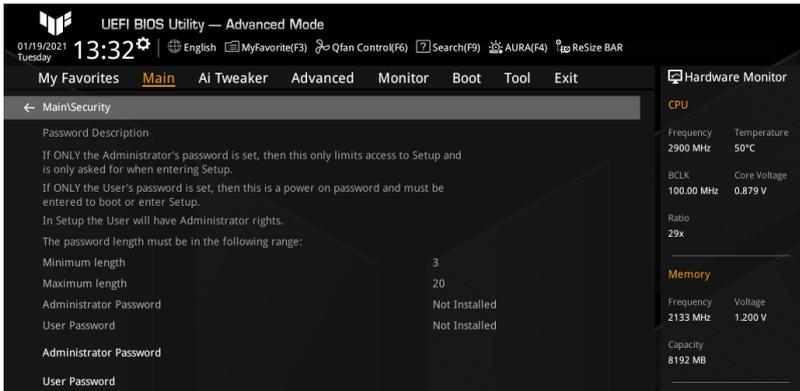Allows you to set the system language.

System Date [Day MM/DD/YYYY]

Allows you to set the system date.

System Time [HH:MM:SS]

Allows you to set the system time.

Security

The Security menu items allow you to change the system security settings.

- If you have forgotten your BIOS password, erase the CMOS Real Time Clock (RTC) RAM to clear the BIOS password. See the user manual bundled with your motherboard for information on how to erase the RTC RAM via the Clear CMOS jumper.

- The Administrator or User Password items on top of the screen show the default **[Not Installed]**. After you set a password, these items show **[Installed]**.

Administrator Password

If you have set an administrator password, we recommend that you enter the administrator password for accessing the system. Otherwise, you might be able to see or change only selected fields in the BIOS Setup program.

To set an administrator password:

1. Select the **Administrator Password** item and press <Enter>.
2. From the **Create New Password** box, key in a password, then press <Enter>.
3. Re-type to confirm the password then select **Ok**.

To change an administrator password:

1. Select the **Administrator Password** item and press <Enter>.
2. From the **Enter Current Password** box, key in the current password, then press <Enter>.
3. From the **Create New Password** box, key in a new password, then press <Enter>.
4. Re-type to confirm the password then select **Ok**.

To clear the administrator password, follow the first and second steps as in changing an administrator password, but leave the other boxes blank then select **Ok** to continue. After you clear the password, the **Administrator Password** item on top of the screen shows **[Not Installed]**.

User Password

If you have set a user password, you must enter the user password for accessing the system. The User Password item on top of the screen shows the default **[Not Installed]**. After you set a password, this item shows **[Installed]**.

To set a user password:

1. Select the **User Password** item and press <Enter>.
2. From the **Create New Password** box, key in a password, then press <Enter>.
3. Re-type to confirm the password then select **Ok**.

To change a user password:

1. Select the **User Password** item and press <Enter>.
2. From the **Enter Current Password** box, key in the current password, then press <Enter>.
3. From the **Create New Password** box, key in a new password, then press <Enter>.
4. Re-type to confirm the password then select **Ok**.

To clear the user password, follow the first and second steps as in changing a user password, but leave the other boxes blank then select **Ok** to continue. After you clear the password, the **User Password** item on top of the screen shows **[Not Installed]**.

6 Ai Tweaker menu

The Ai Tweaker menu items allow you to configure overclocking-related items.

Be cautious when changing the settings of the Ai Tweaker menu items. Incorrect field values can cause the system to malfunction.

The configuration options for this section vary depending on the motherboard model,as well as the CPU and DIMM model you installed on the motherboard.
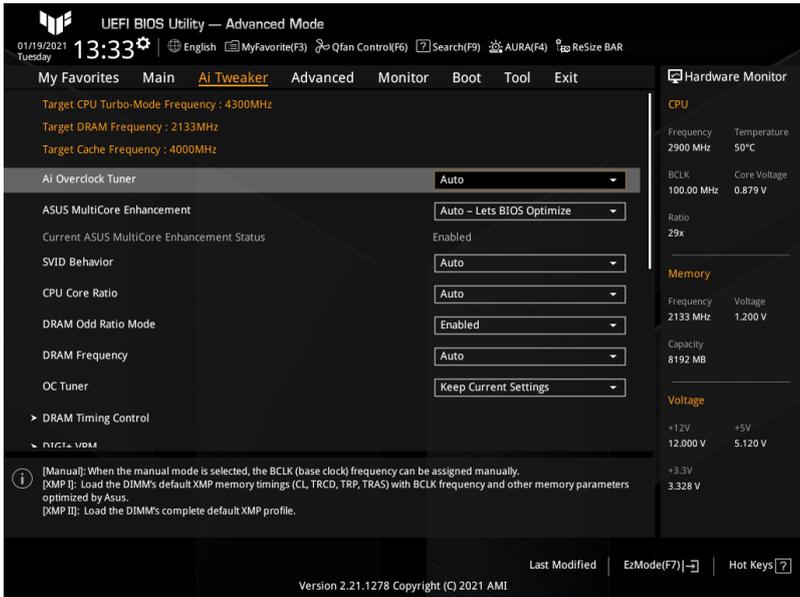
Ai Overclock Tuner

Allows you to select the CPU overclocking options to achieve the desired CPU internal frequency. Configuration options: [Auto] [Manual]

[Auto]   Loads the optimzed settings for the system.

[Manual]   Allows you to assign the BCLK (base clock) frequency manually.

The following two items appear only when you set **Ai Overclock Tuner** to **[Manual]**.

BCLK Frequency

Allows you to set the BCLK frequency to alter the operating frequency of all associated clock domains including CPU, DRAM, and Cache. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press <Enter> to apply the optimized setting. Configuration options: [Auto] [98.0000] – [538.0000]

We recommend you to set the value based on the CPU specification, as high BCLK frequencies may damage the CPU permanently.

BCLK Spread Spectrum

Allows you to enable the BCLK Spread Spectrum to reduce peak value of EMI emission, or disable it for a more accurate Base Clock. Configuration options: [Auto] [Enabled] [Disabled]

ASUS MultiCore Enhancement

Configuration options: [Auto - Lets BIOS Optimize] [Disabled - Enforce All limits] [Enabled - Remove All limits]

[Auto - Lets BIOS Optimize]	ASUS optimized core ratio Turbo and temperature settings at default processor speeds.
[Disabled - Enforce All limits]	Intel default Turbo core ratio settings.
[Enabled - Remove All limits]	Optimized power, temperature and current thresholds for maintaining maximum performance without letting temperature exceed 90°C.

SVID Behavior

Allows you to select the CPU's SVID behavior based on CPU's quality. The more optimistic the mode selected is, the lower the temperature of the CPU will be.
Configuration options: [Auto] [Best-Case Scenario] [Typical Scenario] [Worst-Case Scenario] [Intel's Fail Safe]

CPU Core Ratio

Allows you to select the CPU core ratio.
Configuration options: [Auto] [Sync All Cores] [By Core Usage]

[Auto]	The system will adjust all core ratios automatically.
[Sync All Cores]	Configure a core ratio limit to synchronize all cores.
[By Core Usage]	Configure the ratio limits for active cores depending on how many cores are being utilized.

The following item appears when you set **CPU Core Ratio** to **[Sync All Cores]**.

ALL-Core Ratio Limit

Allows you to set the core ratio limit for all CPU cores. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press <Enter> to apply the optimized setting. Configuration options: [Auto] [8] – [43]

The following item appears when you set **CPU Core Ratio** to **[By Core Usage]**.

1(~6)-Core Ratio Limit

These items allow you to set the core ratio limit for each CPU core individually. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press <Enter> to apply the optimized settings. Configuration options: [Auto] [8] – [43]

DRAM Odd Ratio Mode

Allows you to enable or disable availability of odd DRAM ratios for improved granularity. Configuration options: [Enabled] [Disabled]

DRAM Frequency

Allows you to select the DRAM operating frequency or select [Auto] to apply the optimized setting. Configuration options: [Auto] [DDR4-784MHz] – [DDR4-45907MHz]

> The configuration options vary with the **BCLK Frequency** setting.

> Selecting a very high memory frequency may cause the system to become unstable! If this happens, revert to the default setting.

OC Tuner

Allows you to select the mode of OC Tuner. OC Tuner automatically overlocks the CPU or DRAM frequencies and voltage for an enhanced system performance depending on the DRAM type and an accelerated iGPU performance depending on the iGPU loading. Install an effecient CPU fan for OC Tunder I or Tunder II mode selection.
Configuration options: [Keep Current Settings] [OC Tunner I] [OC Tunner II]

DRAM Timing Control

The sub-items in this menu allow you to set the DRAM timing control features. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press <Enter> to apply the optimized setting for each of the sub-items below.

> Changing the values in this menu may cause the system to become unstable! If this happens, revert to the default settings.

Primary Timings

DRAM CAS# Latency

Configuration options: [Auto] [1] – [31]

DRAM RAS# to CAS# Delay

Configuration options: [Auto] [1] – [63]

DRAM RAS# ACT Time

Configuration options: [Auto] [1] – [63]

DRAM Command Rate

Configuration options: [Auto] [1N] [2N] [3N] [N:1]

> The following item appears only when you set **DRAM Command Rate** to **[N:1]**.

N to 1 ratio

Configuration options: [1] – [7]

Secondary Timings

DRAM RAS# to RAS# Delay L / DRAM RAS# to RAS# Delay S

Configuration options: [Auto] [1] – [15]

DRAM REF Cycle Time / DRAM REF Cycle Time 2 / DRAM REF Cycle Time 4

Configuration options: [Auto] [1] – [1023]

DRAM Refresh Interval

Configuration options: [Auto] [1] – [65535]

DRAM WRITE Recovery Time

Configuration options: [Auto] [1] – [31]

DRAM READ to PRE Time

Configuration options: [Auto] [1] – [15]

DRAM FOUR ACT WIN Time

Configuration options: [Auto] [1] – [63]

**DRAM WRITE to READ Delay / DRAM WRITE to READ Delay L /
DRAM WRITE to READ Delay S**

Configuration options: [Auto] [1] – [15]

DRAM CKE Minimum Pulse Width

Configuration options: [Auto] [0] – [15]

DRAM Write Latency

Configuration options: [Auto] [1] – [31]

Skew Control

    ODT RTT WR (CHA) / ODT RTT WR (CHB)

    Configuration options: [Auto] [0 DRAM Clock] [80 DRAM Clock]
                  [120 DRAM Clock] [240 DRAM Clock] [255 DRAM Clock]

    **ODT RTT PARK (CHA) / ODT RTT NOM (CHA) / ODT RTT PARK (CHB) /
    ODT RTT NOM (CHB)**

    Configuration options: [Auto] [0 DRAM Clock] [34 DRAM Clock]
                  [40 DRAM Clock] [48 DRAM Clock] [60 DRAM Clock]
                  [80 DRAM Clock] [120 DRAM Clock] [240 DRAM Clock]

    **ODT_READ_DURATION / ODT_READ_DELAY / ODT_WRITE_DURATION /
    ODT_WRITE_DELAY**

    Configuration options: [Auto] [0] – [7]

    **Data Rising Slope / Cmd Rising Slope / Ctl Rising Slope / Clk Rising Slope /
    Data Falling Slope / Cmd Falling Slope / Ctl Falling Slope / Clk Falling Slope**

    Configuration options: [Auto] [0] – [15]

    **Data Rising Slope Offset / Cmd Rising Slope Offset /
    Ctl Rising Slope Offset / Clk Rising Slope Offset /
    Data Falling Slope Offset / Cmd Falling Slope Offset /
    Ctl Falling Slope Offset / Clk Falling Slope Offset**

    Configuration options: [Auto] [0] [1]

RTL IOL Control

    DRAM RTL INIT value

    Configuration options: [Auto] [0] – [127]

    DRAM IOL INIT value(CHA) / DRAM IOL INIT value(CHB)

    Configuration options: [Auto] [0] – [15]

DRAM RTL (CHA DIMM0 Rank0) / DRAM RTL (CHA DIMM0 Rank1) / DRAM RTL (CHA DIMM1 Rank0) / DRAM RTL (CHA DIMM1 Rank1) / DRAM RTL (CHB DIMM0 Rank0) / DRAM RTL (CHB DIMM0 Rank1) / DRAM RTL (CHB DIMM1 Rank0) / DRAM RTL (CHB DIMM1 Rank1)

Configuration options: [Auto] [0] – [127]

DRAM IOL (CHA DIMM0 Rank0) / DRAM IOL (CHA DIMM0 Rank1) / DRAM IOL (CHA DIMM1 Rank0) / DRAM IOL (CHA DIMM1 Rank1) / DRAM IOL (CHB DIMM0 Rank0) / DRAM IOL (CHB DIMM0 Rank1) / DRAM IOL (CHB DIMM1 Rank0) / DRAM IOL (CHB DIMM1 Rank1)

Configuration options: [Auto] [0] – [15]

CHA IO_Latency_offset / CHB IO_Latency_offset

Configuration options: [Auto] [0] – [127]

CHA RFR delay / CHB RFR delay

Configuration options: [Auto] [0] – [127]

Memory Training Algorithms

Early Command Training

Configuration options: [Auto] [Disabled] [Enabled]

SenseAmp Offset Training

Configuration options: [Disabled] [Enabled]

Early ReadMPR Timing Centering 2D

Configuration options: [Disabled] [Enabled]

Read MPR Training

Configuration options: [Disabled] [Enabled]

Receive Enable Training

Configuration options: [Disabled] [Enabled]

Jedec Write Leveling

Configuration options: [Disabled] [Enabled]

LPDDR4 Write DQ DQS Retraining

Configuration options: [Disabled] [Enabled]

Early Write Time Centering 2D

Configuration options: [Auto] [Disabled] [Enabled]

Early Read Time Centering 2D

Configuration options: [Auto] [Disabled] [Enabled]

Write Timing Centering 1D

Configuration options: [Disabled] [Enabled]

Write Voltage Centering 1D

Configuration options: [Auto] [Disabled] [Enabled]

Read Timing Centering 1D

Configuration options: [Auto] [Disabled] [Enabled]

Dimm ODT Training*

Allows you to enable or disable DIMM On-Die Termination Training.
Configuration options: [Auto] [Disabled] [Enabled]

The following item will be inaccessible if you set **Dimm ODT Training** to **[Disabled]**.

Max RTT_WR

Configuration options: [ODT Off] [120 Ohms]

DIMM RON Training*

Configuration options: [Auto] [Disabled] [Enabled]

Write Drive Strength/Equalization 2D*

Configuration options: [Auto] [Disabled] [Enabled]

Write Slew Rate Training*

Configuration options: [Auto] [Disabled] [Enabled]

Read ODT Training*

Configuration options: [Auto] [Disabled] [Enabled]

Read Equalization Training*

Configuration options: [Auto] [Disabled] [Enabled]

Read Amplifier Training*

Configuration options: [Auto] [Disabled] [Enabled]

Write Timing Centering 2D

Configuration options: [Auto] [Disabled] [Enabled]

Read Timing Centering 2D

Configuration options: [Auto] [Disabled] [Enabled]

Command Voltage Centering

Configuration options: [Auto] [Disabled] [Enabled]

Write Voltage Centering 2D

Configuration options: [Auto] [Disabled] [Enabled]

Read Voltage Centering 2D

Configuration options: [Auto] [Disabled] [Enabled]

Late Command Training

Configuration options: [Disabled] [Enabled] [Auto]

Round Trip Latency

Configuration options: [Auto] [Disabled] [Enabled]

Turn Around Timing Training

Configuration options: [Disabled] [Enabled]

Rank Margin Tool

Configuration options: [Disabled] [Enabled] [Minimal] [Auto]

Rank Margin Tool Per Bit

Configuration options: [Disabled] [Enabled]

Margin Check Limit

Configuration options: [Disabled] [L1] [L2] [Both]

The following item is accessible only when you set **Margin Check Limit** to **[L2]** or **[Both]**.

Margin Limit Check L2

Configuration options: [1] – [300]

Memory Test

Configuration options: [Disabled] [Enabled]

DIMM SPD Alias Test

Configuration options: [Auto] [Disabled] [Enabled]

Receive Enable Centering 1D

Configuration options: [Auto] [Disabled] [Enabled]

Retrain Margin Check

Configuration options: [Disabled] [Enabled]

Write Drive Strength Up/Dn independently

Configuration options: [Disabled] [Enabled]

CMD Slew Rate Training

Configuration options: [Auto] [Disabled] [Enabled]

CMD Drive Strength and Tx Equalization

Configuration options: [Auto] [Disabled] [Enabled]

Command Normalization

Configuration options: [Disabled] [Enabled]

Early DQ Write Strength and Equalization Training

Configuration options: [Disabled] [Enabled]

Read Voltage Centering 1D

Configuration options: [Disabled] [Enabled]

Dimm ODT CA Training

Configuration options: [Disabled] [Enabled]

DQ DFE Training

Configuration options: [Disabled] [Enabled]

Third Timings

tRDRD_sg_Training / tRDRD_sg_Runtime / tRDRD_dg_Training / tRDRD_dg_Runtime / tRDWR_sg / tRDWR_dg / tWRWR_sg / tWRWR_dg

Configuration options: [Auto] [0] – [63]

tWRRD_sg

Configuration options: [Auto] [0] – [127]

tWRRD_dg

Configuration options: [Auto] [0] – [63]

tRDRD_dr / tRDRD_dd / tRDWR_dr / tRDWR_dd / tWRWR_dr / tWRWR_dd / tWRRD_dr / tWRRD_dd

Configuration options: [Auto] [0] – [63]

TWRPRE

Configuration options: [Auto] [0] – [127]

TRDPRE

Configuration options: [Auto] [0] – [15]

tREFIX9

Configuration options: [Auto] [0] – [127]

OREF_RI

Configuration options: [Auto] [0] – [255]

TXP

Configuration options: [Auto] [0] – [15]

PPD

Configuration options: [Auto] [0] [1]

Misc.

MRC Fast Boot

Allows you to enable or disable fast path through the MRC.
Configuration options: [Auto] [Disabled] [Enabled]

Delay after Train

Allows you to enable or disable DRAM to delay 10 seconds after training to reach a certain temperature during extreme overclocking.
Configuration options: [Disabled] [Enabled]

DRAM CLK Period

Allows you to select the DRAM clock period. Configuration options: [Auto] [1] – [58]

Memory Scrambler

Allows you to enable or disable Memory Scrambler support.
Configuration options: [Disabled] [Enabled]

Channel A DIMM Control / Channel B DIMM Control

Allow you to enable or disable DIMMs on Channel A(/B).
Configuration options: [Enable both DIMMs] [Disable DIMM0] [Disable DIMM1] [Disable both DIMMs]

MCH Full Check

Allows you to enable MCH Full Check to enhance the system stability, or disable it to enhance DRAM overclocking capability.
Configuration options: [Auto] [Disabled] [Enabled]

Mem Over Clock Fail Count

Configuration options: [Auto] [1] – [255]

Training Profile

Allows you to select DIMM Training Profile.
Configuration options: [Auto] [Standard Profile] [ASUS User Profile]

DLLBwEn

Allows you to set the DLLBwEn value. Select values 2 to 4 for best Memory overclocking. Configuration options: [Auto] [0] – [7]

Legacy Mode

Configuration options: [Disabled] [Enabled]

SPD Write Disable

Allows you to enable or disable setting SPD Write Disable. For security recommendations, SPD Write Disable bit must be set. Configuration options: [TRUE] [FALSE]

DIGI+ VRM

Changing the values in this menu may cause the system to become unstable! If this happens, revert to the default settings.

CPU Load-line Calibration

The load-line is defined by the Intel VRM specification and affects the level of voltage supplied to the processor. Higher load-line calibration settings result in reduced VDroop at the expense of voltage overshoot and will increase CPU temperature due to higher voltage under load. Select from Level 1 to 7 to adjust the load-line slope. Level 1 represents greater VDroop, and Level 7 minimum VDroop.
Configuration options: [Auto] [Level 1] [Level 2] [Level 3] [Level 4:Recommended for DC]
[Level 5] [Level 6] [Level 7]

The actual performance boost may vary depending on your CPU specification.

DO NOT remove the VRM heatsink.

Synch ACDC Loadline with VRM Loadline

When this item is set to [Enabled], VRM Loadline will be adjust automatically to match AC/DC Loadline. Configuration options: [Disabled] [Enabled]

CPU Current Capability

This item allows you to set the shut-off current limit for external voltage regulator. A higher setting will allow the voltage regulator to supply more current while a lower setting will cause the voltage regulator to shut off the system when the supplied current is higher than the set value. Configuration options: [Auto] [100%] [110%] [120%] [130%] [140%] [150%] [160%] [170%]

Configure higher values when overclocking or when using higher current demanding stress tests.

CPU VRM Switching Frequency

This item allows you to set the VRM switching frequency. VRM switching frequency affects transient response and VRM component temperatures. Configure a higher switching frequency for better transient response at the expense of higher VRM temperatures. Active cooling of the VRM heatsink is recommended when running high CPU voltage and high load-line calibration values.
Configuration options: [Auto] [Manual]

DO NOT remove the VRM heatsink.

The following item appears when you set **CPU VRM Switching Frequency** to **[Manual]**.

Fixed CPU VRM Switching Frequency(KHz)

Allows you to set the VRM switching frequency manually. The switching frequency will affect the VRM transient response and the component thermal production. Configure a higher frequency for a quicker transient respond speed. Use the <+> and <-> keys to adjust the value.
Configuration options: [250] [300] [350] [400] [450] [500]

CPU Power Duty Control

Allows you to adjusts the duty cycle of each VRM phase based upon current and/or temperature. Configuration options: [T.Probe] [Extreme]

[T.Probe]	Sets the buck controller to balance VRM FET temperatures.
[Extreme]	Sets the buck controller to balance per phase current.

DO NOT remove the thermal module when setting this item to **[Extreme]**. The thermal conditions should be monitored.

CPU Power Phase Control

Allows you to set the power phase control of the CPU.
Configuration options: [Auto] [Standard] [Extreme]

[Standard]	The number of active phases is controlled by the CPU.
[Extreme]	Sets to the full phase mode.

DO NOT remove the thermal module when setting this item to **[Extreme]**. The thermal conditions should be monitored.

CPU VRM Thermal Control

When this item is set to [Disabled], the temperature limit of the CPU VRM will be increased. Configuration options: [Auto] [Disabled] [Enabled]

Internal CPU Power Management

The sub-items in this menu allow you to set the Internal CPU Power Managemnt features. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press the <Enter> key to apply the optimized setting for each of the sub-items below.

CPU Core/Cache Current Limit Max.

Allows you to configure a current limit for frequency or power throttling. Setting this item to the maximum value can prevent throttling when overclocking.
Configuration options: [Auto] [0.00] – [255.75]

Long Duration Package Power Limit

This item is an Intel parameter known as "power limit 1" and specified in Watts. The default value is defined by TDP of the processor. Increasing the value will allow the Turbo ratio to be maintained for a longer duration under higher current loads.
Configuration options: [Auto] [1] – [4095]

Package Power Time Window

This item is an Intel parameter known as [power limit 1] and specified in seconds. The applied value indicates how long the Turbo ratio can be active when TDP is exceeded.
Configuration options: [Auto] [1] – [448]

Short Duration Package Power Limit

This item is an Intel parameter known as "power limit 2" and specified in Watts. It is the second Intel power limit which provides protection when package power exceeds power limit 1. The default setting is 1.25 times power limit 1. According to Intel, the platform must support this value for up to 10msec when power consumption exceeds power limit 2. ASUS motherboards are engineered to support this duration for a longer time as required to facilitate overclocking. Configuration options: [Auto] [1] – [4095]

IA AC Load Line

AC Loadline defined in mOhms. Configuration options: [Auto] [0.01] – [62.49]

IA DC Load Line

DC Loadline defined in mOhms. Configuration options: [Auto] [0.01] – [62.49]

Thermal Velocity Boost

TVB Voltage Optimazations

Allows you to control thermal based voltage optimizations for processors that implement the Intel Thermal Velocity Boost (TVB) feature. Using Overclocking Mailbox command 0x18/0x19. Configuration options: [Auto] [Disabled] [Enabled]

V-Max Stress

When this item is set to [Enabled], frequency may be clipped if the maximum voltage on the silicon is too high. When set to [Disabled], frequency will not be clipped.
Configuration options: [Auto] [Disabled] [Enabled]

Overclocking TVB

Enable this item to be able to draw temperature/frequency dependencies.
Configuration options: [Auto] [Disabled] [Enabled] [+1Boost Profile] [+2Boost Profile]

[+1Boost Profile]	This setting will enable additional boost of one bin with the help of Auto Optimized Temperature Control.
[+2Boost Profile]	This setting will enable additional boost of two bins with the help of Auto Optimized Temparature Control.

1(~6)-Core Active

Configuration options: [Auto] [Enabled]

Temperature A

Package passing this temparature threshold will engage the negative ratio offset specified in Negative Ratio Offset A. The unit of measurement for this item is Degree Celcius. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press the <Enter> key to apply the optimized setting. Configuration options: [Auto] [1] – [115]

Negative Ratio Offset A

This will be the potential negative offset to respective ratio when package temperature rises above threshold specified in Temperature A.
Configuration options: [Auto] [User Specify]

Ratio Offset

Use the <+> or <-> to adjust the value. Configuration options: [0] – [31]

Temperature B for additional -1x Ratio

This can be the second additional temperature threshold which when exceeded, will stack an additional -1x ratio offset to the setting in "Negative Ratio Offset A". This item should logically be higher than Temperature A.
Configuration options: [Auto] [1] – [115]

Tweaker's Paradise

The sub-items in this menu allow you to set the Tweaker's Paradise features. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press the <Enter> key to apply the optimized setting for the sub-items below.

Realtime Memory Timing

Allows you to enable or disable realtime memory timings. When set to [Enabled], the system will allow performing realtime memory timing changes after MRC_DONE. Configuration options: [Disabled] [Enabled]

FCLK Frequency for Early Power On

Configuration options: [Normal (800Mhz)] [1GHz] [400MHz] [Auto]

VPPDDR Voltage

Configuration options: [Auto] [2.5V] [2.6V] [2.7V] [2.8V]

Internal PLL Voltage

Allows you to configure the offset for the Core PLL VCC Trim.
Configuration options: [Auto] [0.900] – [1.845]

GT PLL Voltage

Allows you to configure the offset for the GT PLL VCC Trim.
Configuration options: [Auto] [0.900] – [1.845]

Ring PLL Voltage

Allows you to configure the offset for the Ring PLL VCC Trim.
Configuration options: [Auto] [0.900] – [1.845]

System Agent PLL Voltage

Allows you to configure the offset for the System Agent PLL VCC Trim.
Configuration options: [Auto] [0.900] – [1.845]

Memory Controller PLL Voltage

Allows you to configure the offset for the Memory Controller PLL VCC Trim.
Configuration options: [Auto] [0.900] – [1.845]

CPU Standby Voltage

Allows you to configure the voltage for the CPU Standby.
Configuration options: [Auto] [0.80000] – [1.80000]

Min. CPU Cache Ratio

Allows you to configure the minimum possible CPU cache ratio. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press the <Enter> key to apply the optimized setting. Configuration options: [Auto] [8] – [43]

Max CPU Cache Ratio

Allows you to configure the maximum possible CPU cache ratio. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press the <Enter> key to apply the optimized setting. Configuration options: [Auto] [8] – [43]

CPU Core/Cache Voltage

Allows you to select the mode of voltage fed to the CPU cores.
Configuration options: [Auto] [Manual Mode] [Offset Mode]

[Manual Mode]   Allows user-defined values.

[Offset Mode]   Modifies values by SVID.

> The following item appears when you set **CPU Core/Cache Voltage** to **[Manual Mode]**.

- CPU Core Voltage Override

Allows you to configure the input voltage for the CPU by the external voltage regulator. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press the <Enter> key to apply the optimized setting. Configuration options: [Auto] [0.600] – [1.700]

> The following two items appear when you set **CPU Core/Cache Voltage** to **[Offset Mode]**.

- Offset Mode Sign

Configuration options: [-] [+]
[-]   Offsets the CPU core voltage by a negative value.
[+]   Offsets the CPU core voltage by a positive value.

- CPU Core Voltage Offset

Allows you to configure the input voltage for the CPU by the external voltage regulator.
Configuration options: [Auto] [0.005] – [0.635]

DRAM Voltage

Allows you to configure the voltage for the DRAM. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press the <Enter> key to apply the optimized setting.
Configuration options: [Auto] [1.00000] – [1.80000]

CPU VCCIO Voltage

Allows you to configure the voltage for the CPU VCCIO. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press the <Enter> key to apply the optimized setting.
Configuration options: [Auto] [0.70000] – [1.80000]

CPU System Agent Voltage

Allows you to configure the voltage for the CPU System Agent. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press the <Enter> key to apply the optimized setting.
Configuration options: [Auto] [0.70000] – [1.80000]

PCH VCCIN 1.8V

Allows you to configure the voltage for the PCH Core. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press the <Enter> key to apply the optimized setting.
Configuration options: [Auto] [1.80000] – [2.30000]

DRAM REF Voltage Control

The sub-items in this menu allow you to set the DRAM REF Voltage Control features. Use the <+> or <-> keys to adjust the value, or key in [Auto] and press the <Enter> key to apply the optimized setting for the sub-items below.

DRAM CTRL REF Voltage on CHA / DRAM CTRL REF Voltage on CHB

Allow you to configure the DRAM reference voltage on the control lines of channel A(/B). The reference voltage will be the DRAM voltage times the configured value. Configuring the value close to the standard value (0.60000x) is recommended.
Configuration options: [Auto] [0.39500] – [0.63000]

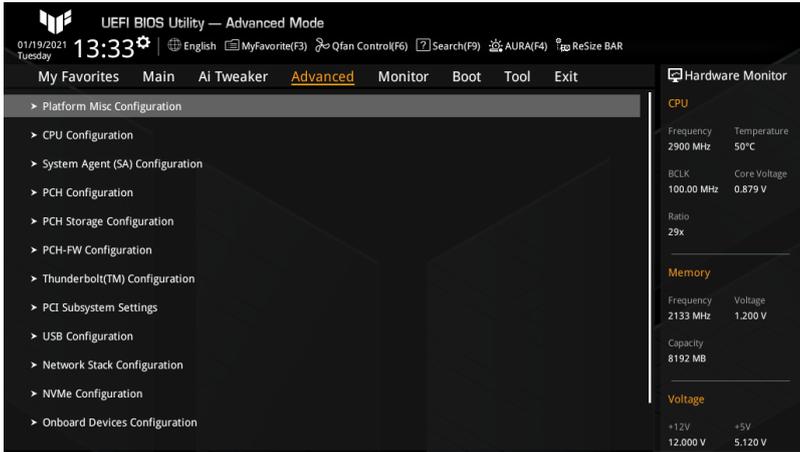### DRAM DATA REF Voltage on CHA(/B) DIMM0(/1) Rank0(/1) BL0(~7)

Configuration options: [Auto] [0] – [63]

7   Advanced menu

The Advanced menu items allow you to change the settings for the CPU and other system devices.
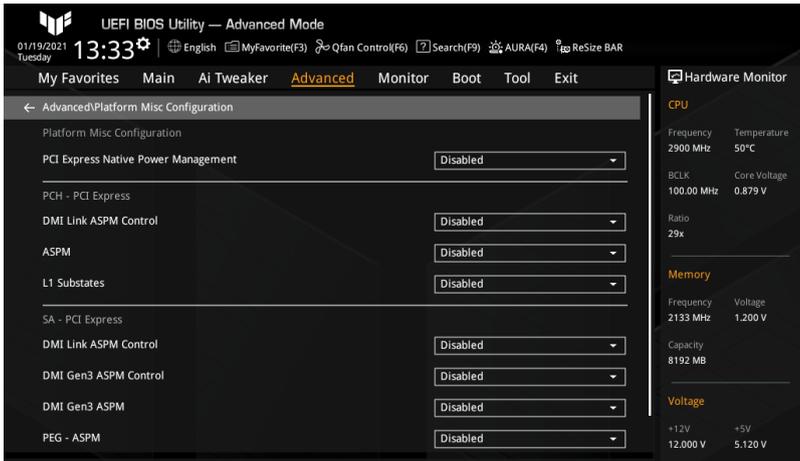
> ⚠ Be cautious when changing the settings of the Advanced menu items. Incorrect field values can cause the system to malfunction.

7.1   Platform Misc Configuration

The items in this menu show the Platform Misc configuration options.

PCI Express Native Power Management

Select [Enabled] to perform Active State Power Management (ASPM) operations in OS for enhanced PCI Express power saving. Configuration options: [Disabled] [Enabled]

> The following item appears only when you set **PCI Express Native Power Management** to **[Enabled]**.

Native ASPM

Configuration options: [Auto] [Enabled] [Disabled]

[Enabled]: OS Controlled ASPM.

[Disabled]: BIOS Controlled ASPM.

PCH - PCI Express

DMI Link ASPM Control

Allows you to set the ASPM level of the DMI link.
Configuration options: [Disabled] [L0s] [L1] [L0sL1] [Auto]

ASPM

Allows you to set the ASPM level.
Configuration options: [Disabled] [L0s] [L1] [L0sL1] [Auto]

[Disabled]:	Disables ASPM.
[L0s]:	Forces all links to the L0s state.
[L1]:	Forces all links to the L1 state.
[L0sL1]:	Forces all links to the L0sL1 state.
[Auto]:	BIOS auto configure.

L1 Substates

Allows you to configure the PCI Express L1 Substates settings.
Configuration options: [Disabled] [L1.1] [L1.1 & L1.2]

SA - PCI Express

DMI Link ASPM Control

Allows you to set the ASPM level on SA side of the DMI link. Configuration options:
[Disabled] [L0s] [L1] [L0sL1]

DMI Gen3 ASPM Control

Allows you to set the level of DMI Gen3 ASPM Control support.
Configuration options: [Disabled] [Auto] [ASPM L0s] [ASPM L1] [ASPM L0sL1]

> L0s is not supported for DMI ASPM for CML/TGP.

DMI Gen3 ASPM

Allows you to set the level of DMI Gen3 ASPM support.
Configuration options: [Disabled] [Auto] [ASPM L0s] [ASPM L1] [ASPM L0sL1]

> L0s is not supported for DMI ASPM for CML/TGP.

PEG - ASPM

Allows you to set the level of the ASPM support for the PEG0. This item will have no effect if PEG is not the currently active device.
Configuration options: [Disabled] [Auto] [ASPM L0s] [ASPM L1] [ASPM L0sL1]

PCI Express Clock Gating

Allows you to enable or disable the PCI Express Clock Gating for each root port.
Configuration options: [Disabled] [Enabled]

7.2 CPU Configuration

This menu displays the CPU-related information that the BIOS detects automatically and the items in this menu allow you to configure the CPU-related settings.

The items in this menu may vary based on the CPU installed.

Tcc Offset Time Window

Allows you to specify the time window for the Running Average Temperature Limit (RATL) feature. RATL allows you to set an average max thermal temperature. Temperatures within the time window can get higher than the temperature threshold but only the average is used to cause frequency clipping.
Configuration options: [Disabled] [5 ms] [10 ms] [55 ms] [156 ms] [375 ms] [500 ms] [750 ms] [1 sec] [2 sec] [3 sec] [4 sec] [5 sec] [6 sec] [7 sec] [8 sec] [10 sec] [12 sec] [14 sec] [16 sec] [20 sec] [24 sec] [28 sec] [32 sec] [40 sec] [48 sec] [56 sec] [64 sec] [80 sec] [96 sec] [112 sec] [128 sec] [160 sec] [192 sec] [224 sec] [256 sec] [320 sec] [384 sec] [448 sec]

Hardware Prefetcher

Allows you to turn on or off the MLC streamer prefetcher.
Configuration options: [Disabled] [Enabled]

Adjacent Cache Line Prefetch

Allows you to turn on or off prefetching of adjacent cache lines.
Configuration options: [Disabled] [Enabled]

Intel (VMX) Virtualization Technology

Allows you to enable or disable a VMM to utilize the additional hardware capacities provided by Vanderpool Technology. Configuration options: [Disabled] [Enabled]

Active Processor Cores

Allows you to select the number of CPU cores to activate in each processor package. Configuration options: [All] [1] [2] [3] [4] [5]

Hyper-Threading

The Intel Hyper-Threading Technology allows a hyper-threading processor to appear as two logical processors, allowing the operating system to schedule two threads or processes simultaneously. Configuration options: [Disabled] [Enabled]

[Disabled]   Only one thread per activated core is enabled.

[Enabled]   Two threads per activated core are enabled.

CPU - Power Management Control

Allows you to configure the Power Management Control options.

Intel(R) SpeedStep(tm)

The Intel® SpeedStep™ Technology allows your system to support more than two frequency ranges. Configuration options: [Auto] [Disabled] [Enabled]

Intel(R) Speed Shift Technology

Allows you to enable or disable the Intel® Speed Shift Technology support. When this item is set to [Enabled], CPPC v2 interface allows hardware controlled P-states. Configuration options: [Disabled] [Enabled]

> The following item appears when you set **Intel(R) SpeedStep(tm)** to **[Auto]** or **[Enabled]**.

Turbo Mode

Allows you to enable or disable processor Turbo Mode. This requires EMTTM to be enabled as well. Configuration options: [Auto] [Disabled] [Enabled]

CPU C-States

Allows you to enable or disable CPU Power Management. Allows CPU to go to C states when it's not fully utilized. Configuration options: [Auto] [Disabled] [Enabled]

> The following items appear only when you set **CPU C-States** to **[Enabled]**.

Thermal Monitor

Allows you to enable or disable Thermal Monitor.
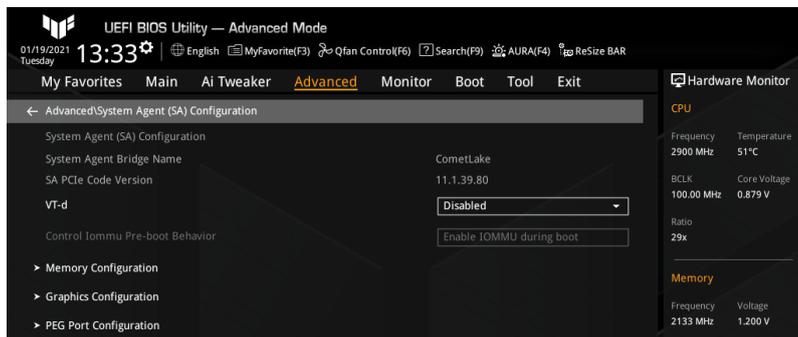Configuration options: [Disabled] [Enabled]

Dual Tau Boost

Allows you to enable or disable Dual Tau Boost feature. This is only applicable for Desktop 35/65/125W sku. When DPTF is enabled, this feature will be ignored. Configuration options: [Auto] [Disabled] [Enabled]

7.3   System Agent (SA) Configuration

The items in this menu show the System Agent (SA) configuration options.

VT-d

Allows you to enable or disable VT-d function on MCH.
Configuration options: [Enabled] [Disabled]

> The following item is accessible only when you set **VT-d** to **[Enabled]**.

Control Iommu Pre-boot Behavior

Allows you to enable or disable Input/Output Memory Management Unit (IOMMU) in Pre-boot environment. This requires that DMAR table is installed in DXE and VTD_INFO_PPI is installed in PEI.
Configuration options: [Disable IOMMU] [Enable IOMMU during boot]

Memory Configuration

Allows you to configure the Memory Configuration parameters.

Memory Remap

Allows you to enable or disable Memory Remap above 4GB.
Configuration options: [Enabled] [Disabled]

Graphics Configuration

Allows you to configure the Graphics Configuration parameters.

Primary Display

Allows you to select which of CPU, PEG, or PCIE graphics devices should be Primary Display. Configuration options: [Auto] [PEG] [PCIE]

PEG Port Configuration
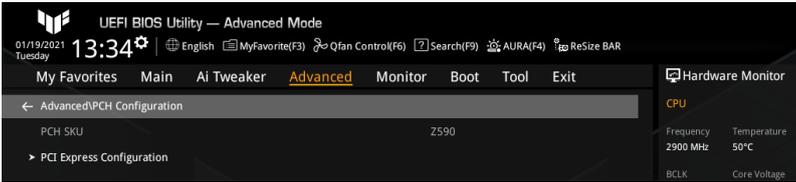
Allows you to configure the PEG Ports options.

PCIEX16_1 Link Speed

Allows you to configure the PCIEx16 speed for slot 1.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

7.4   PCH Configuration

The items in this menu allow you to set the PCH parameters.


PCI Express Configuration

Allows you to configure the PCI Express Configuration settings.

PCIe Speed

Allows you to set the PCIe speed. Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

7.5   PCH Storage Configuration

The items in this menu show the PCH Storage Configuration options. While entering Setup, the BIOS automatically detects the presence of SATA devices. The SATA Port items show Empty if no SATA device is installed to the corresponding SATA port.
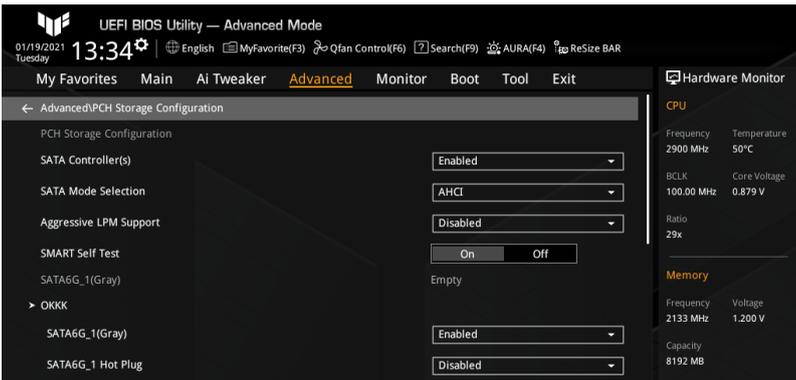
SATA Controller(s)

This item allows you to enable or disable the SATA device.
Configuration options: [Enabled] [Disabled]

> The following items appear only when you set **SATA Controller(s)** to **[Enabled]**.

SATA Mode Selection

Determines how SATA controller(s) operate. Configuration options: [AHCI]

Aggressive LPM Support

Allows you to enable or disable PCH to aggressively enter link power state.
Configuration options: [Disabled] [Enabled]

SMART Self Test

The SMART (Self-Monitoring, Analysis and Reporting Technology) is a monitoring system that shows a warning message during POST (Power-on Self Test) when any error occurs in the hard disks. Configuration options: [On] [Off]

SATA6G_1(~6)(Gray)

Allows you to change the name of the SATA port. Press <Enter> and a popup window appears. Enter a new name, then press <Enter> or click the Ok button to confirm the change.

SATA6G_1(~6)(Gray)

Allows you to enable or disable the SATA port. Configuration options: [Disabled] [Enabled]

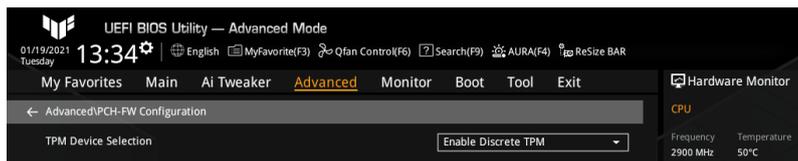### SATA6G_1(~6) Hot Plug

Allows you to designate the SATA port as Hot Pluggable.
Configuration options: [Disabled] [Enabled]

7.6   PCH-FW Configuration

The items in this menu allow you to configure the Management Engine Technology parameters.

TPM Device Selection

Allows you to select TPM device.
Configuration options: [Enable Discrete TPM] [Enable Firmware TPM]

[Enable Discrete TPM]   Enables Discrete TPM, disables platform Firmware TPM.

[Enable Firmware TPM]   Enables platform Firmware TPM, disables Discrete TPM.

- Intel® PTT is a hardware TPM 2.0 implementation integrated in Intel® ME/CSME/TXE for credential storage and key management. The firmware TPM key will be stored in Intel® ME data region once you enable Intel® PTT and Windows® BitLocker for drive encryption.

- Please note that when the recovery key is lost or when the BIOS ROM chip is replaced, the system will not boot into the operating system and the data will stay encrypted and cannot be restored.

7.7 Thunderbolt(TM) Configuration

The items in this menu show the Thunderbolt™ Configuration options.
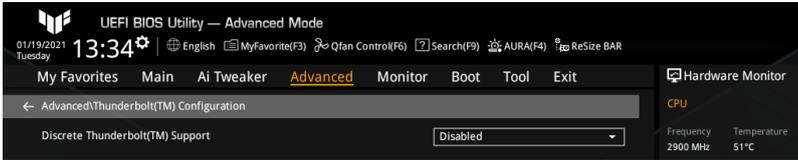
Discrete Thunderbolt(TM) Support

Allows you to enable or disable Discrete Thunderbolt™ Support.
Configuration options: [Disabled] [Enabled]

> • The following items appear when you set **Discrete Thunderbolt(TM) Support** to **[Enabled]**.
>
> • Please set **Control Iommu Pre-boot Behavior** in **System Agent (SA) Configuration** menu to **[Enable IOMMU during boot]** to support DMA Protection feature.

Wake From Thunderbolt(TM) Devices

Allows you to enable or disable system wake from Thunderbolt™ devices.
Configuration options: [On] [Off]

Disable PCIE Tunneling Over USB4

Allows you to disable retry PCIE Tunneling Over USB4.
Configuration options: [Disabled] [Enabled]

Native OS security for TBT

Allows you to enable or disable the Native OS security solution for Thunderbolt™ hosts.
Configuration options: [Disabled] [Enabled]

Discrete Thunderbolt(TM) Configuration

Allows you to configure the Discrete Thunderbolt™ related settings.

Thunderbolt Usb Support

Setting this item to [Enabled] will allow boot from USB devices which is present behind Thunderbolt™. Configuration options: [Disabled] [Enabled]

Thunderbolt Boot Support

Setting this item to [Enabled] will allow boot from bootable devices which is present behind Thunderbolt™. Configuration options: [Disabled] [Enabled]

Titan Ridge Workaround for OSUP

Allows you to enable or disable Titan Ridge Workaround for OSUP.
Configuration options: [Disabled] [Enabled]

Tbt Dynamic AC/DC L1

Allows you to enable or disable the Tbt Dynamic AC/DC L1 support.
Configuration options: [Disabled] [Enabled]

GPIO3 Force Pwr

Allows you to enable or disable GPIO3. Configuration options: [On] [Off]

Wait time in ms after applying Force Pwr

Allows you to set the wait time specified in milli second after Force Pwr is asserted before access the TBT controller. Configuration options: [1] – [5000]

GPIO filter

GPIO filter is needed to avoid electrical noise on PCH GPIOs during hotplug of 12V USB devices. Configuration options: [Disabled] [Enabled]

DTBT Controller 0 Configuration

Allows you to configure the DTBT Controller 0 Configuration options. For items without a pop-up menu, you can either enter a number within the valid input range or use the <+> or <-> to set the values.

DTBT Controller 0

Configuration options: [Disabled] [Enabled]

DTbt Root Port Type

Allows you to select the TBT Root Port Type.
Configuration options: [PCH Root Port] [PEG Root Port]

TBT Host Router

Allows you to enable the host router based on the ports available.
Configuration options: [One port [Two port]

Extra Bus Reserved

Configuration options: [0] – [255]

| [56] | One port Host. |
| [106] | Two port Host. |

Reserved Memory

Allows you to set the reserved memory specified in MB for the Root Bridge.
Configuration options: [1] – [4096]

Memory Alignment

This item is specified in bit. Configuration options: [0] – [31]

Reserved PMemory

Allows you to set the reserved prefetchable memory specified in MB for the Root Bridge. Configuration options: [1] – [4096]

PMemory Alignment

This item is specified in bit. Configuration options: [0] – [31]

Reserved I/O

Configuration options: [0] – [60]
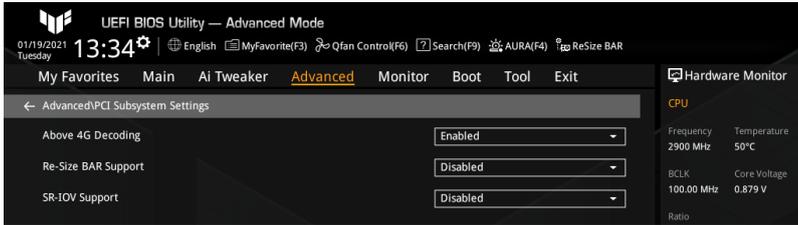
Thunderbolt(TM) OS select

Windows 10 Thunderbolt support

Configuration options: [Enable + RTD3] [Disabled]

7.8   PCI Subsystem Settings

The items in this menu allow you to set PCI, PCI-X, and PCI Express settings.

Above 4G Decoding

Allows you to enable or disable 64-bit capable devices to be decoded in Above 4G Address Space. This requires that the system supports 64-bit PCI Decoding.
Configuration options: [Enabled] [Disabled]

> • **Above 4G Decoding** can only be enabled under 64-bit operating system.
>
> • The following item appears only when you set **Above 4G Decoding** to **[Enabled]**.

Re-Size BAR Support

Allows you to enable or disable Resizable BAR Support. This requires that the system has Resizable BAR capable PCIe devices and the system supports 64-bit PCI Decoding. Configuration options: [Disabled] [Auto]

> To enable **Re-Size BAR Support** for harnessing full GPU memory, please go to the **Boot** menu to disable **CSM (Compatibility Support Module)**.

SR-IOV Support

Allows you to enable or disable Single Root IO Virtualization Support. This requires that the system has SR-IOV capable PCIe devices. Configuration options: [Disabled] [Enabled]

7.9   USB Configuration

The items in this menu display and allow you to change the USB-related features.
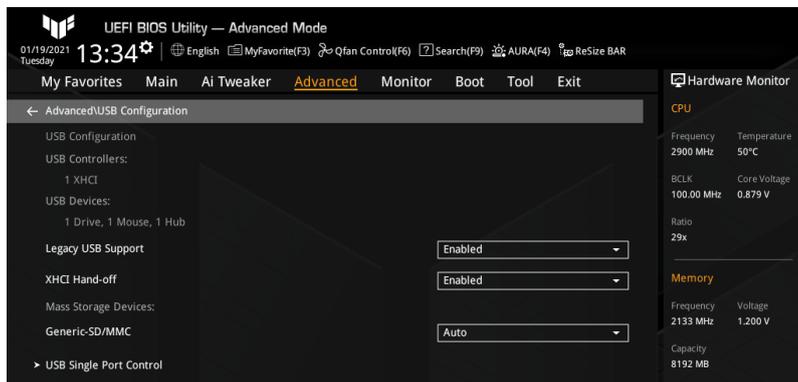
Legacy USB Support

Configuration options: [Enabled] [Disabled] [Auto]

[Enabled]   Enables the Legacy USB support.

[Disabled]   USB devices are available only for EFI applications.

[Auto]   Your system automatically detects the presence of USB devices at startup. If any USB devices are detected, the Legacy USB support is enabled.

XHCI Hand-off

This is a workaround for OSes without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver. Configuration options: [Enabled] [Disabled]

> The following item appears only when you have mass storage device(s) installed on your motherboard and will be inaccessible if you set **Legacy USB Support** to **[Disabled]**.

Mass Storage Devices: Generic-SD/MMC

Allows you to set the emulation types of the mass storage devices you installed on your motherboard. [Auto] emulates devices according to their media format. Optical drives are emulated as CDROM, drives with no media will be emulated according to the drive type. Configuration options: [Auto] [Floppy] [Forced FDD] [Hard Disk] [CD-ROM]

USB Single Port Control

Allows you to enable or disable the corresponding USB port from reporting a Device Connection to the controller.
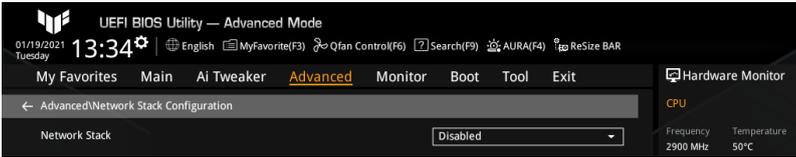
U32G2_3(/4) / USB3.2_5 / U32G1_7(~10) / USB11(/12) / U32G2X2_1

These items allow you to enable or disable the selected USB port.
Configuration options: [Disabled] [Enabled]

7.10 Network Stack Configuration

The items in this menu allow you to enable or disable the UEFI network stack.

Network Stack

Allows you to enable or disable the UEFI network stack.
Configuration options: [Disabled] [Enabled]

> The following items appear only when you set **Network Stack** to **[Enabled]**.

IPv4 PXE Support

Allows you to enable or disable the IPv4 PXE Boot Support. If this item is set to [Disabled], IPv4 PXE boot option will not be created.
Configuration options: [Disabled] [Enabled]

IPv6 PXE Support

Allows you to enable or disable the IPv6 PXE Boot Support. If this item is set to [Disabled], IPv6 PXE boot option will not be created.
Configuration options: [Disabled] [Enabled]

7.11 NVMe Configuration

This menu displays the NVMe controller and drive information of the connected devices. The screen shows No NVME Device Found if no NVME device is detected.
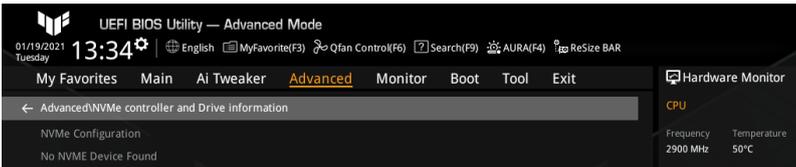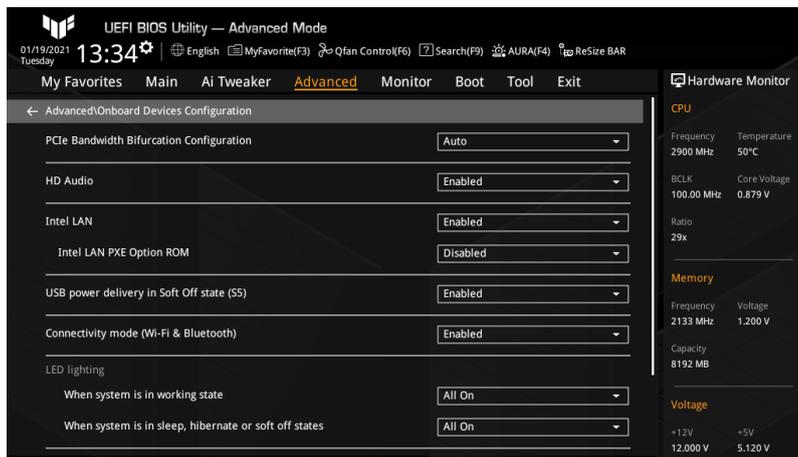
7.12 Onboard Devices Configuration

The items in this menu allow you to switch between PCIe Lanes and configure onboard devices.

The items in this menu may vary by motherboard models.

PCIe Bandwidth Bifurcation Configuration

Configuration options: [Auto] [X8/X8] [PCIe RAID mode]

[Auto]	Runs full PCIe X16 mode.
[X8/X8]	PCIEX16_1 runs X8/X8 mode.
[PCIe RAID mode]	Up to three SSDs installed onto the Hyper M.2 X16 series card can be detected.

HD Audio

Allows you to enable or disable the HD-Audio (HDA) device.

Configuration options: [Disabled] [Enabled]

[Disabled]	HDA will be unconditionally disabled.
[Enabled]	HDA will be unconditionally enabled.

Intel LAN

Allows you to enable or disable Intel LAN. Configuration options: [Disabled] [Enabled]

The following item appears only when you set **Intel LAN** to **[Enabled]**.

Intel LAN PXE Option ROM

Allows you to enable or disable Intel LAN PXE OPROM.
Configuration options: [Disabled] [Enabled]

USB power delivery in Soft Off state (S5)

Allows you to disable USB power when your PC is in the S5 state.

Configuration options: [Disabled] [Enabled]

Connectivity mode (Wi-Fi & Bluetooth)

Allows you to enable or disable the Wi-Fi and Bluetooth connectivity module.

Configuration options: [Disabled] [Enabled]

LED lighting

Allows you to configure the RGB LED lighting effect.

When system is in working state

Configuration options: [All On] [Stealth Mode] [Aura Only] [Aura Off]

When system is in sleep, hibernate or soft off states

Configuration options: [All On] [Stealth Mode] [Aura Only] [Aura Off]

[All On]   All LEDs work properly.
[Stealth Mode]   All LEDs are disabled.
[Aura Only]   RGB LEDs work properly, while Functional LEDs are disabled.
[Aura Off]   Functional LEDs work properly, whille RGB LEDs are disabled.

> RGB headers and Addressable RGB headers will only work under the S0 (working) state.

M.2_2 Configuration

Configuration options: [Auto] [SATA] [PCIE]

[Auto]   Auto-detects the M.2_2 device mode. If a SATA device is detected, SATA6G_2 will be disabled.

[SATA]   Only supports M.2_2 SATA devices. Please note that SATA6G_2 port cannot be used in this mode.

[PCIE]   Only supports M.2_2 PCIe devices.

M.2_3 & SATA6G_56 switch

Configuration options: [Auto] [M.2_3] [SATA6G_5 & SATA6G_6]

[Auto]   Automatically detects the device installed. When both M.2_3 and SATA6G_5 or SATA6G_6 are installed with devices, SATA6G_56 will be disabled by default.

[M.2_3]   M.2_3 shares bandwidth with SATA6G_56. When M.2_3 is occupied, SATA6G_56 will be disabled.

[SATA6G_5 & SATA6G_6]   SATA6G_56 share bandwidth with M.2_3. When SATA6G_5 or SATA6G_6 is occupied, M.2_3 will be disabled.

Serial Port Configuration

Allows you to set the parameters of serial port.

> The options under **Serial Port Configuration** function only when the motherboard includes serial port (COM) connector(s).

Serial Port

Allows you to enable or disable serial port. Configuration options: [On] [Off]

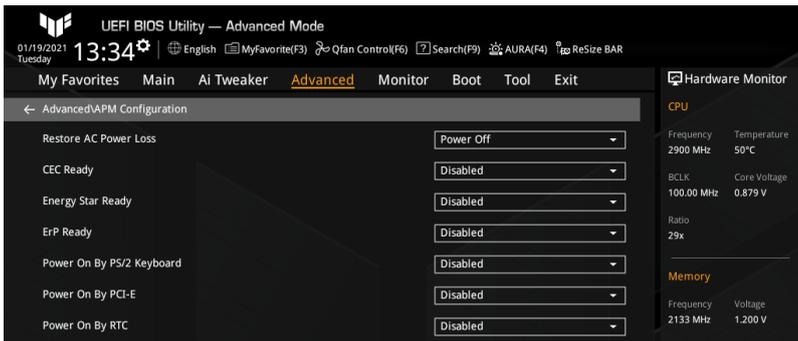> The following item appears only when you set **Serial Port** to **[On]**.

Change Settings

Allows you to select an optimal settings for Super IO device.
Configuration options: [IO=3F8h; IRQ=4] [IO=2F8h; IRQ=3] [IO=3E8h; IRQ=4]
[IO=2E8h; IRQ=3]

7.13   APM Configuration

The items in this menu allow you to adjust the Advanced Power Management (APM) settings.

Restore AC Power Loss

Allows you to select the AC power state when power is re-applied after a power failure.
Configuration options: [Power On] [Power Off] [Last State]

CEC Ready

When this item is set to [Enabled], the system will comply with CEC (California Energy
Commission) regulations and save more power under S0 state.
Configuration options: [Disabled] [Enabled]

Energy Star Ready

Configuration options: [Disabled] [Enabled]

ErP Ready

Allows you to switch off some power at S4/S5 to get the system ready for ErP requirement.
When this item is set to [Enabled], all other PME options will be switched off. RGB LEDs and
RGB/Addressable RGB headers will also be disabled.
Configuration options: [Disabled] [Enable(S4+S5)] [Enable(S5)]

Power On By PS/2 Keyboard

Allows you to enable or disable power-on by your PS/2 keyboard, or to select a way to switch
the power on using your PS/2 keyboard.
Configuration options: [Disabled] [Space Bar] [Ctrl-Esc] [Power Key]

Power On By PCI-E

Allows you to enable or disable the wake-on-LAN function of the onboard LAN controller or other installed PCI-E LAN cards. Configuration options: [Disabled] [Enabled]

Power On By RTC

Allows you to enable or disable Real-Time Clock (RTC) to generate a wake event and configure the RTC alarm date. When this item is set to [Enabled], you can set the days, hours, minutes, or seconds to schedule an RTC alarm date either using the <+> or <-> keys or by entering a number directly within the valid input range.
Configuration options: [Disabled] [Enabled]

> The following items appear only when you set **Power On By RTC** to **[Enabled]**.

RTC Alarm Date (Days)

Allows you to set the days of RTC alarm. [0] represents "Every Day".
Configuration options: [0] – [31]

- Hour

Configuration options: [0] – [23]

- Minute

Configuration options: [0] – [59]

- Second

Configuration options: [0] – [59]

7.14   HDD/SSD SMART Information

This menu displays the SMART information of the connected devices.

> NVM Express devices do not support SMART information.

Device

Allows you to select a device and displays its SMART information. If no HDD/SSD device is detected on the motherboard, the field shows [N/A].

8 Monitor menu

The Monitor menu displays the system temperature/power status, and allows you to change the fan settings.
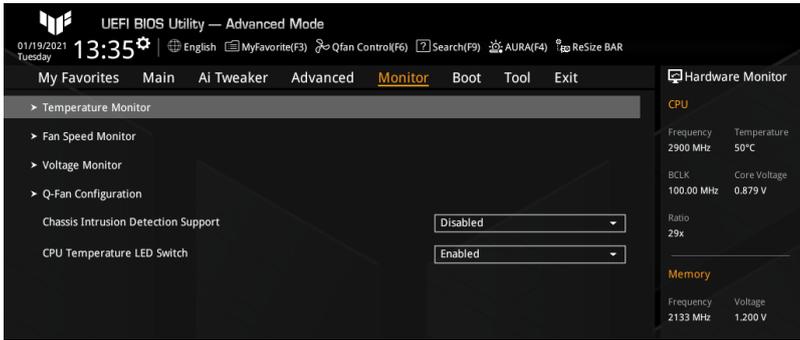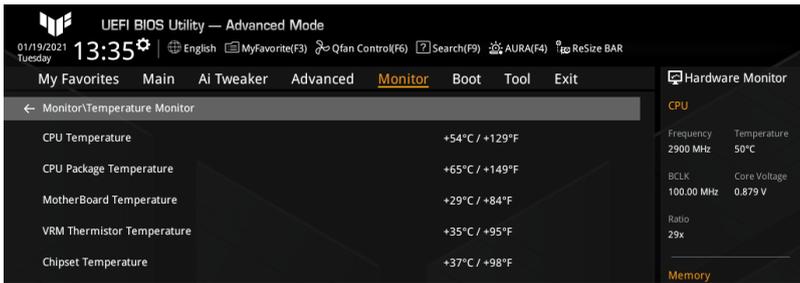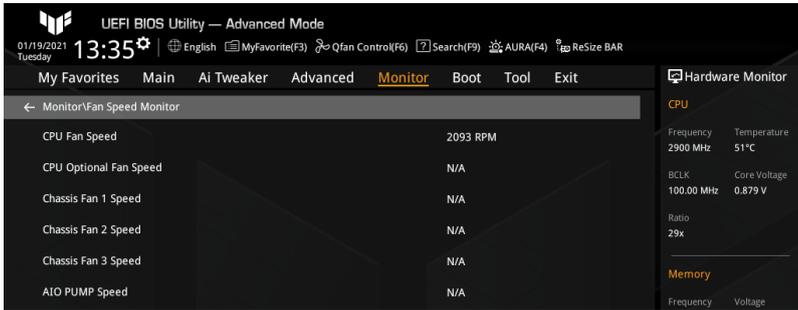

8.1 Temperature Monitor

CPU Temperature / CPU Package Temperature / MotherBoard Temperature / VRM Temperature / Chipset Temperature [xxx°C/xxx°F]

The onboard hardware monitor automatically detects and displays the CPU, CPU package, motherboard, VRM, and chipset temperatures. Select **[Ignore]** if you do not wish to display the detected temperatures.

8.2   Fan Speed Monitor

CPU Fan Speed / CPU Optional Fan Speed / Chassis Fan 1(~3) Speed / AIO PUMP Speed [xxxx RPM]

The onboard hardware monitor automatically detects and displays the CPU fan, CPU optional fan, chassis fan 1~3, and AIO pump fan speeds in rotations per minute (RPM). If the fan is not connected to the motherboard, the field shows [N/A]. Select **[Ignore]** if you do not wish to display the detected speed.
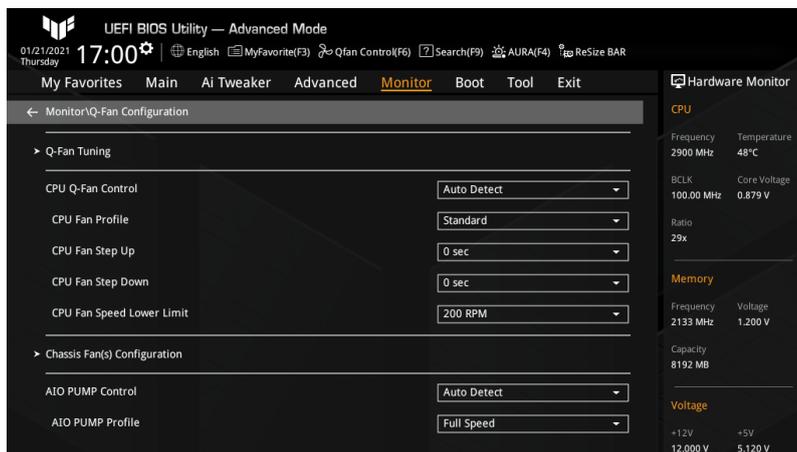
8.3   Voltage Monitor
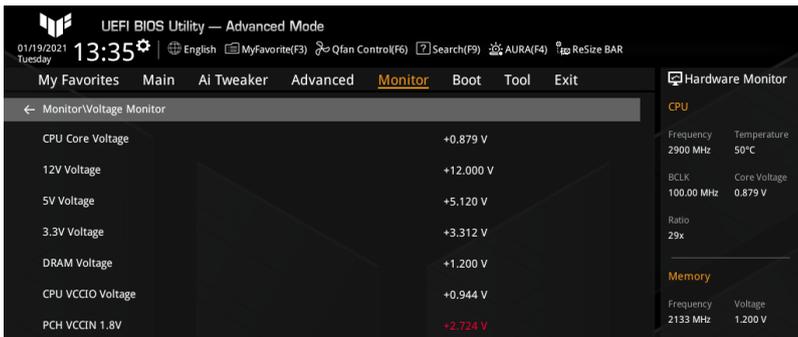
CPU Core Voltage / 12V Voltage / 5V Voltage / 3.3V Voltage / DRAM Voltage / CPU VCCIO Voltage / PCH VCCIO 1.8V [xx.xxx V]

The onboard hardware monitor automatically detects the voltage output through the onboard voltage regulators. Select **[Ignore]** if you do not wish to display the detected voltage output.

8.4   Q-Fan Configuration

Q-fan Tuning

Select this item and press <Enter>, a popup window appears. Click the Ok button to allow the system to automatically detect the lowest speed and configure the minimum duty cycle for each fan.

> The tuning progress may take 2 to 5 minutes, DO NOT shut down or reset your system during this process.

CPU Q-Fan Control

Allows you to set the CPU Q-Fan control mode.
Configuration options: [Auto Detect] [DC Mode] [PWM Mode]

[Auto Detect]	Detects the type of CPU fan installed and automatically switches the control modes.
[DC Mode]	Enables the Q-Fan control in DC mode for 3-pin fan.
[PWM Mode]	Enables the Q-Fan control in PWM mode for 4-pin fan.

CPU Fan Profile

Allows you to select the appropriate performance level for the assigned fan.
Configuration options: [Standard] [Silent] [Turbo] [Full Speed] [Manual]

> If you wish to set **CPU FAN Profile** to **[Manual]**, we suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty.

> The following items will not appear if you set **CPU Fan Profile** to **[Full Speed].**

CPU Fan Step Up/Down

These items allow you to set the values of the CPU fan step up/down. Configuration options: [0 sec] [2.1 sec] [2.8 sec] [3.6 sec] [4.2 sec] [5.0 sec] [6.3 sec] [8.5 sec] [12 sec] [25 sec]

CPU Fan Speed Lower Limit

Allows you to set the lower speed limit for CPU fan. A warning message will appear when the limit is reached. When set to [Ignore], no future warning message will appear. Configuration options: [Ignore] [200 RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

- The following items appear only when you set the **CPU Fan Profile** to **[Manual]**.

- Use the <+> and <-> keys to adjust the value or directly key in a desired value within the valid range for each of the items below.

CPU Upper Temperature

Allows you to set the upper limit of the CPU temperature. CPU fan will operate at the maximum duty cycle when the source temperature reaches the limit. Configuration options: [0] – [100]

The upper temperature cannot be lower than the lower temperature.

CPU Fan Max. Duty Cycle (%)

Allows you to set the maximum fan duty cycle and the source temperature upper limit. When the source temperature reaches the upper limit, CPU fan will operate at the maximum duty cycle. Configuration options: [20] – [100]

CPU Middle Temperature

Allows you to set the CPU middle temperature. CPU fan will operate at the middle duty cycle when the source temperature is higher than the limit. Configuration options: [0] – [100]

CPU Fan Middle Duty Cycle (%)

Allows you to set the middle fan duty cycle and the source temperature upper limit. When the source temperature reaches the middle limit, CPU fan will operate at the middle duty cycle. Configuration options: [20] – [100]

CPU Lower Temperature

Allows you to set the CPU lower temperature. CPU fan will operate at the minimum duty cycle when the source temperature is lower than the limit. Configuration options: [0] – [100]

CPU Fan Min. Duty Cycle (%)

Allows you to set the minimum fan duty cycle. When the temperature is lower than the lower limit, CPU fan will operate at the minimum duty cycle. Configuration options: [20] – [100]

Chassis Fan(s) Configuration

Allows you to configure the settings of the Chassis fans.

The number of the Chassis fans may vary by motherboard models.

Chassis Fan 1(~3) Q-Fan Control

These items allow you to set the control modes for chassis fans.

Configuration options: [Auto Detect] [DC Mode] [PWM Mode]

[Auto Detect]   Detects the type of chassis fan installed and automatically switches the control modes.

[DC Mode]   Enables the Q-Fan control in DC mode for 3-pin fan.

[PWM Mode]   Enables the Q-Fan control in PWM mode for 4-pin fan.

Chassis Fan 1(~3) Profile

Allow you to set the appropriate performance levels for chassis fans.

If **Chassis FAN 1(~3) Profile** is set to **[Manual]**, we suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty.

The following items will not appear if you set **Chassis Fan 1(~3) Profile** to **[Full Speed].**

Chassis Fan 1(~3) Q-Fan Source

Chassis fans will be controlled according to the selected temperature sources.
Configuration options: [CPU] [MotherBoard] [VRM] [Chipset] [Multiple Sources]

The following items appear only when you set **[Chassis Fan 1(~3) Q-Fan Source]** to **[Multiple Sources]**.

Temperature Source 1(~3)

These items allow you to select up to three temperature sources and chassis fans will automatically change based on the highest temperature.
Configuration options: [CPU] [MotherBoard] [VRM] [Chipset] [N/A]

Chassis Fan 1(~3) Step Up/Down

Allow you to set the values of chassis fans step up/down.
Configuration options: [0 sec] [12 sec] [25 sec] [51 sec] [76 sec] [102 sec] [127 sec] [153 sec] [178 sec] [204 sec]

Chassis Fan 1(~3) Fan Speed Low Limit

Allow you to set the lower speed limit for chassis fans. A warning message will appear when the limit is reached. When set to [Ignore], no future warning message will appear. Configuration options: [Ignore] [200 RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

- The following items appear only when you set **Chassis Fan 1(~3) Profile** to **[Manual].**

- Use the <+> and <-> keys to adjust the value or directly key in a desired value within the valid range for each of the items below.

Chassis Fan 1(~3) Upper Temperature

Allow you to set the upper limit of the chassis temperature. Chassis fans will operate at the maximum duty cycle when the source temperature reaches the limit. Configuration options: [0] – [100]

The upper temperature cannot be lower than the lower temperature.

Chassis Fan 1(~3) Max. Duty Cycle (%)

Allow you to set the maximum fan duty cycle and the source temperature upper limit. When the source temperature reaches the upper limit, chassis fans will operate at the maximum duty cycle. Configuration options: [0] – [100]

Chassis Fan 1(~3) Middle Temperature

Allow you to set the middle temperature. Chassis fans will operate at the middle duty cycle when the source temperature is higher than the limit. Configuration options: [0] – [100]

Chassis Fan 1(~3) Middle Duty Cycle (%)

Allow you to set the middle fan duty cycle and the source temperature upper limit. When the source temperature reaches the middle limit, chassis fans will operate at the middle duty cycle. Configuration options: [0] – [100]

Chassis Fan 1(~3) Lower Temperature

Allow you to set the lower temperature. Chassis fans will operate at the minimum duty cycle when the source temperature is lower than the limit. Configuration options: [0] – [100]

Chassis Fan 1(~3) Min Duty Cycle (%)

Allow you to set the minimum fan duty cycle. When the temperature is lower than the lower limit, chassis fans will operate at the minimum duty cycle. Configuration options: [0] – [100]

AIO PUMP Control

Allows you to set AIO Pump fan control mode.
Configuration options: [Auto Detect] [DC Mode] [PWM Mode]

[Auto Detect]   Detects the type of AIO Pump fan installed and automatically switches the control modes.

[DC Mode]   Enables the Q-Fan control in DC mode for 3-pin fan.

[PWM Mode]   Enables the Q-Fan control in PWM mode for 4-pin fan.

AIO PUMP Profile

Allows you to select the appropriate performance level for AIO Pump fan.
Configuration options: [Standard] [Silent] [Turbo] [Full Speed] [Manual]

If **AIO PUMP Profile** is set to **[Manual]**, we suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty.

The following items will not appear if you set **AIO PUMP Profile** to **[Full Speed].**

AIO PUMP Fan Q-Fan Source

AIO Pump fan will be controlled according to the selected temperature source.
Configuration options: [CPU] [MotherBoard] [VRM] [Chipset] [Multiple Sources]

The following items appear only when you set **[AIO PUMP Fan Q-Fan Source]** to **[Multiple Sources]**.

Temperature Source 1(~3)

These items allow you to select up to three temperature sources and AIO Pump fan will automatically change based on the highest temperature. Configuration options: [CPU] [MotherBoard] [VRM] [Chipset] [N/A]

AIO PUMP Step Up/Down

Allows you to set the value of AIO PUMP fan step up/down.
Configuration options: [0 sec] [12 sec] [25 sec] [51 sec] [76 sec] [102 sec] [127 sec] [153 sec] [178 sec] [204 sec]

AIO PUMP Speed Low Limit

Allows you to set the lower speed limit for AIO PUMP fan. A warning message will appear when the limit is reached. When set to [Ignore], no future warning message will appear. Configuration options: [Ignore] [200 RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

- The following items appear only when you set **AIO PUMP Profile** to **[Manual].**

- Use the <+> and <-> keys to adjust the value or directly key in a desired value within the valid range for each of the items below.

AIO PUMP Upper Temperature

Allows you to set the upper limit of AIO PUMP temperature. AIO PUMP fan will operate at the maximum duty cycle when the source temperature reaches the limit. Configuration options: [0] – [100]

The upper temperature cannot be lower than the lower temperature.

AIO PUMP Max. Duty Cycle (%)

Allows you to set the maximum fan duty cycle and the source temperature upper limit. When the source temperature reaches the upper limit, AIO PUMP fan will operate at the maximum duty cycle. Configuration options: [60] – [100]

AIO PUMP Middle Temperature

Allows you to set the middle temperature. AIO PUMP fan will operate at the middle duty cycle when the source temperature is higher than the limit. Configuration options: [0] – [100]

AIO PUMP Middle Duty Cycle (%)

Allows you to set the middle fan duty cycle and the source temperature upper limit. When the source temperature reaches the middle limit, AIO PUMP fan will operate at the middle duty cycle. Configuration options: [60] – [100]

AIO PUMP Lower Temperature

Allows you to set the lower temperature. AIO PUMP fan will operate at the minimum duty cycle when the source temperature is lower than the limit. Configuration options: [0] – [100]

AIO PUMP Min Duty Cycle (%)

Allows you to set the minimum fan duty cycle. When the temperature is lower than the lower limit, AIO PUMP fan will operate at the minimum duty cycle. Configuration options: [60] – [100]

Chassis Intrusion Detection Support

This item allows you to enable or disable the chassis intrusion detection function. Configuration options: [Disabled] [Enabled]

CPU Temperature LED Switch

This item allows you to enable or disable the CPU Temperature LED to light up to indication high CPU temperature. Configuration options: [Disabled] [Enabled]
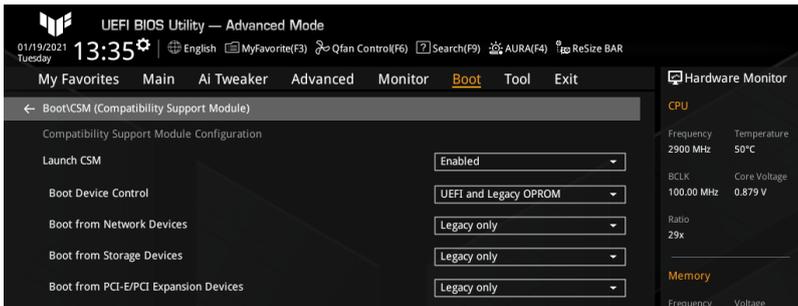
9 Boot menu

The Boot menu items allow you to change the system boot options.
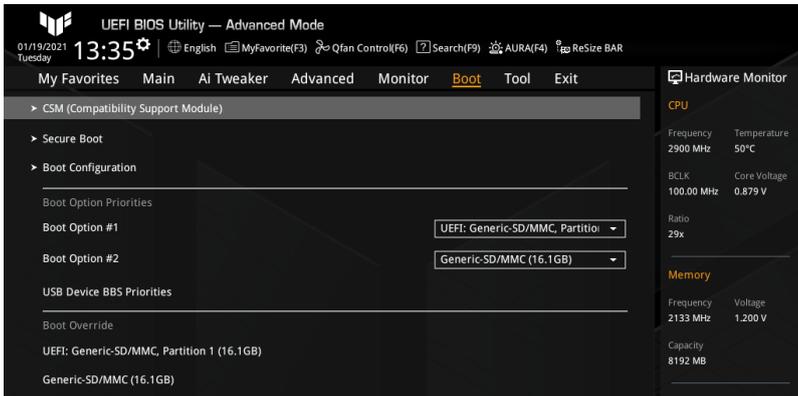
9.1 CSM (Compatibility Support Module)

The items in this menu allow you to configure the CSM (Compatibility Support Module) items to fully support the various VGA, bootable devices and add-on devices for better compatibility.

Launch CSM

Configuration options: [Disabled] [Enabled]

[Enabled]   For better compatibility, enable the CSM to fully support the non-UEFI driver add-on devices or the Windows® UEFI mode.

[Disabled]   Disable the CSM to fully support the non-UEFI driver add-on devices or the Windows® UEFI mode.

Due to Microsoft Secure Boot regulations, ensure the Microsoft signed UEFI driver is contained in the plugged PCI-E based storage including M.2 SSD before setting **[Launch CSM]** to **[Disabled]**. Otherwise, the PCI-E based storages will be only available for the data drive usage. Contact the PCI-E storage vendor for the UEFI driver availability details.

> The following items appear only when you set **[Launch CSM]** to **[Enabled]**.

Boot Device Control

Allow you to select the devices boot-up mode by the devices specification. Devices with the selected mode will appear in the boot priority list.
Configuration options: [UEFI and Legacy OPROM] [Legacy OPROM only] [UEFI only]

Boot from Network Devices

Allow you to select the type of the onboard LAN controllers and installed LAN cards. Network devices will run the selected type during the system boot. Set this item to [Ignore] if you wish to accelerate the boot up time without running network devices during POST. Configuration options: [Ignore] [UEFI only] [Legacy only]

Boot from Storage Devices

Allow you to select the type which the storage devices will run first during the system boot. Set this item to [Ignore] if you wish to accelerate the boot up time without running storage devices during POST. It is recommended to select either [Legacy only] or [UEFI only] by the devices specification for a better stability.
Configuration options: [Ignore] [UEFI only] [Legacy only]

Boot from PCI-E/PCI Expansion Devices

Allow you to select the type the PCI-E/PCI Expansion devices will run first during the system boot. Configuration options: [Ignore] [UEFI only] [Legacy only]

9.2 Secure Boot

This item allows you to configure the Windows® Secure Boot settings and manage its keys to protect the system from unauthorized access and malwares during POST.
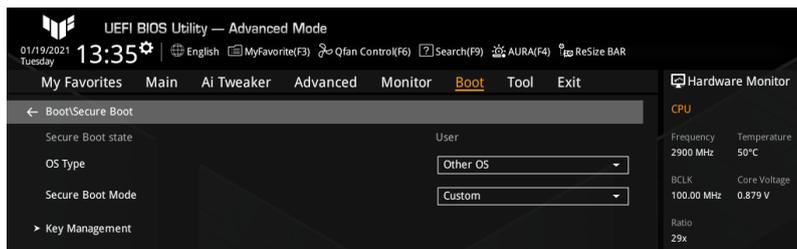
OS Type

Allows you to select your installed operating system.
Configuration options: [Other OS] [Windows UEFI mode]

[Other OS]   Select this option to get the optimized functions when booting on Windows® non-UEFI mode and Microsoft secure boot only non-compliant systems.

[Windows UEFI mode] Executes the Microsoft secure boot check. Only select this option when booting on Windows® UEFI mode or other Microsoft secure boot compliant operating system.

> The Microsoft secure boot can only function properly on Windows® UEFI mode.

Secure Boot Mode

Allows you to select the Secure Boot mode. In Cutom mode, Secure Boot Policy variables can be configured by a physically present user without full authentication.
Configuration options: [Standard] [Custom]

The following item is accessible only when you set **[Secure Boot Mode]** to **[Custom]**.

Key Management

Allows you to manage the secure boot keys.

The following item appears only when all secure boot keys have been delected.

Install Default Secure Boot Keys

Allows you to load default secure variables. After you press <Enter>, a confirmation message appears. Use the left or right arrow key to select between [Yes] or [No], then press <Enter> to confirm your choice.

The following items is accessible when secure variables have been loaded.

Clear Secure Boot keys

Allows you to clear all default Secure Boot keys. After you press <Enter>, a confirmation message appears. Use the left or right arrow key to select between [Yes] or [No], then press <Enter> to confirm your choice.

Save all Secure Boot variables

Allows you to save the NVRAM content of Secure Boot policy variables to the files (EFI_SIGNATURE_LIST data format) in root folder on a target file system device. After you press <Enter>, a popup window appears displaying the available file system(s). Select a file system and use the left or right arrow key to select between [Yes] or [No], then press <Enter> to confirm your choice.

PK Management

The Platform Key (PK) locks and secures the firmware from any permissible changes. The system verifies the PK before your system enters the operating system.

Save To File

Allows you to save the PK to a target file system device.

Set New Key

A popup window will appear if you press <Enter>. Select [Yes] if you wish to load factory default PK, or [No] to load PK from a target file system device.

Delete key

Allows you to delete the PK from NVRAM.

Removing PK will reset the system to Setup/Audit mode.

The PK file must be formatted as a UEFI variable structure with time-based authenticated variable.

KEK Management

The Key Exchange Keys (KEK) manages the Signature database (db) and Forbidden Signature database (dbx).

Key Exchange Keys (KEK) refers to Microsoft Secure Boot Key-Enrollment Key (KEK).

Save To File

Allows you to save the KEK to a target file system device.

Set New Key

A popup window will appear if you press <Enter>. Select [Yes] if you wish to load factory default KEK, or [No] to load KEK from a target file system device.

Append Key

A popup window will appear if you press <Enter>. Select [Yes] if you wish to load factory default KEK, or [No] to load additional KEK from a target file system device for an additional db and dbx loaded management.

Delete key

This item allows you to delete the KEK from NVRAM. Select [Yes] if you wish to delect the variable, or [No] to choose a certificate to be delected from the key database.

The KEK file must be formatted as a UEFI variable structure with time-based authenticated variable.

DB Management

The Authorized Signatures (db) lists the signers or images of UEFI applications, operating system loaders, and UEFI drivers that you can load on the single computer.

Save To File

Allows you to save the db to a target file system device.

Set New Key

A popup window will appear if you press <Enter>. Select [Yes] if you wish to load factory default db, or [No] to load db from a target file system device.

Append Key

A popup window will appear if you press <Enter>. Select [Yes] if you wish to load factory default db, or [No] to load additional db from a target file system device for an additional db and dbx loaded management.

Delete key

Allows you to delete the db from NVRAM. Select [Yes] if you wish to delect the variable, or [No] to choose a certificate to be delected from the key database.

The db file must be formatted as a UEFI variable structure with time-based authenticated variable.

DBX Management

The Forbidden Signature database (dbx) lists the forbidden images of db items that are no longer trusted and cannot be loaded.

Save To File

Allows you to save the dbx to a target file system device.

Set New Key

A popup window will appear if you press <Enter>. Select [Yes] if you wish to load factory default dbx, or [No] to load dbx from a target file system device.

Append Key

A popup window will appear if you press <Enter>. Select [Yes] if you wish to load factory default db, or [No] to load additional dbx from a target file system device for an additional db and dbx loaded management.

Delete key

Allows you to delete the dbx from NVRAM. Select [Yes] if you wish to delect the variable, or [No] to choose a certificate to be delected from the key database.

The dbx file must be formatted as a UEFI variable structure with time-based authenticated variable.

9.3   Boot Configuration

The items in this menu allow you to configure Boot-related settings.

Fast Boot

Allows you to enable or disable boot with initialization of a minimal set of devices required to launch active boot option. Configuration options: [Disabled] [Enabled]

> The following item appears only when you set **Fast Boot** to **[Enabled]**.

Next Boot after AC Power Loss

Configuration options: [Normal Boot] [Fast Boot]

[Normal Boot]   Returns to normal boot on the next boot after an AC power loss.

[Fast Boot]   Accelerates the boot speed on the next boot after an AC power loss.

Boot Logo Display

Configuration options: [Auto] [Full Screen] [Disabled]

[Auto]   Automatically adjusts the boot logo size for Windows® requirements.

[Full Screen]   Maximizes the boot logo size.

[Disabled]   Hide the boot logo during the POST.

> The following item appears when you set **Boot Logo Display** to **[Auto]** or **[Full Screen]**.

POST Delay Time

Allows you to select a desired additional waiting time before the POST to easily enter the BIOS Setup. It is only recommended to set the POST delay time during a normal boot system boot. Configuration options: [0 sec] – [10 sec]

> The following item appears only when you set **Boot Logo Display** to **[Disabled]** and **Wait For 'F1' If Error** to **[Enabled]**.

POST Report

Allows you to select a desired POST report waiting time.
Configuration options: [1 sec] – [10 sec] [Until Press ESC]

Bootup NumLock State

Allows you to enable or disable power-on state of the keyboard NumLock.
Configuration options: [On] [Off]

Wait For 'F1' If Error

Allows your system to pause until the <F1> key is pressed when any error occurs.
Configuration options: [Disabled] [Enabled]

AMI Native NVMe Driver Support

Allows you to enable or disable AMI Native NVMe driver.
Configuration options: [Disabled] [Enabled]

Option ROM Messages

Configuration options: [Force BIOS] [Keep Current]

[Force BIOS]   The option ROM messages will be displayed during the POST.

[Keep Current]   Only the ASUS logo will be shown during the POST.

Interrupt 19 Capture

Allows you to enable or disable the option ROMs to trap the interrupt 19.
Configuration options: [Disabled] [Enabled]

Setup Mode

Allows you to select the default setup mode of the BIOS after POST.
Configuration options: [Advanced Mode] [EZ Mode]

Boot Sector (MBR/GPT) Recovery Policy

Allows you to select the Boot Sector Policy.
Configuration options: [Auto Recovery] [Local User Control]

[Auto Recovery]	Follows UEFI Rule.
[Local User Control]	Allows you to enter setup page and select Boot Sector (MBR/GPT) Recovery Policy to recovery MBR/GPT on the next boot time.

The following item appears only when you set **Boot Sector (MBR/GPT) Recovery Policy** to **[Local User Control]**.

Next Boot Recovery Action

Allows you to select the (MBR/GPT) recovery action on the next boot. When [Recovery] is selected, a confirmation message appears. Select [Yes] is you wish to run Boot Sector recovery process on the next boot, or [No] to cancel.
Configuration options: [Skip] [Recovery]

Please note that the current GPT header will not be able to restore back after the recovering process!

Boot Option Priorities

These items specify the boot device priority sequence from the available devices. The number of device items that appears on the screen depends on the number of devices installed in the system.

- To access Windows® OS in Safe Mode, press <F8 > after POST (Windows® 8 not supported).

- To select the boot device during system startup, press <F8> when ASUS Logo appears.

Boot Override

These items display the available devices. The number of device items that appear on the screen depends on the number of devices installed in the system. Click an item to start booting from the selected device.

10   Tool menu

The Tool menu items allow you to configure options for special functions. Select an item then press <Enter> to display the submenu.
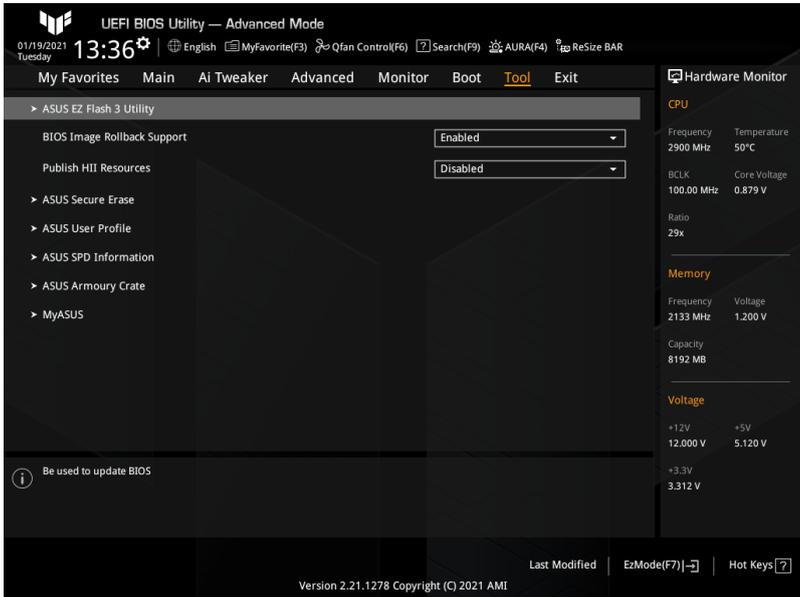
ASUS EZ Flash 3 Utility

Allows you to update your BIOS.

> For more details, refer to the section **12.2 ASUS EZ Flash 3**.

> • DO NOT shut down or reset the system while updating the BIOS to prevent system boot failure!
>
> • We recommend that you update the BIOS file only coming from the same memory/CPU configuration and BIOS version.

BIOS Image Rollback Support

Configuration options: [Enabled] [Disabled]

[Enabled]   Supports roll back your BIOS to a previous version, but this setting violates the NIST SP 800-147 requirement.

[Disabled]   Only supports update your BIOS to a newer version, and this setting meets the NIST SP 800-147 requirement.

Publish HII Resources

Configuration options: [Enabled] [Disabled]

ASUS Secure Erase

SSD speed performance may degrade over time due to accumulated files and frequent data-writing. Secure Erase completely cleans your SSD and restores it to factory default settings.

⚠️ Ensure that you run Secure Erase on a compatible SSD. Running Secure Erase on an incompatible SSD will render the SSD totally unusable.

✏️
- The time to erase the contents of your SSD may take a while depending on its size. Do not turn off the system during the process.
- For the list of Secure Erase-compatible SSDs, visit the ASUS Support site at www.asus.com/support.

Displays the available SSDs
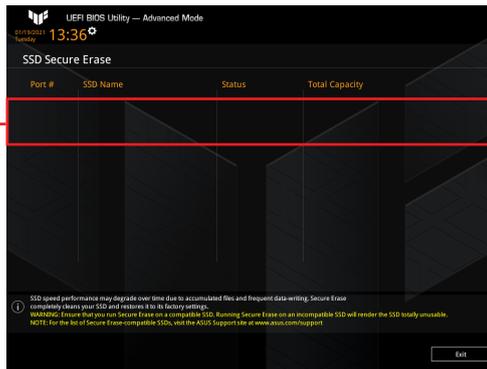
✏️ **Status definition:**
- **Frozen.** The frozen state is the result of a BIOS protective measure. The BIOS guards drives that do not have password protection by freezing them prior to booting. If the drive is frozen, a power off or hard reset of your PC must be performed to proceed with the ASUS Secure Erase.
- **Locked.** SSDs might be locked if the Secure Erase process is either incomplete or was stopped. This may be due to a third party software that uses a different password defined by ASUS. You have to unlock the SSD in the software before proceeding with ASUS Secure Erase.

ASUS User Profile

Allows you to store or load multiple BIOS settings and displays the status of the user profiles.

Load from Profile

Allows you to load the previous BIOS settings saved in the BIOS Flash. Key in the number of the profile you wish to load, press <Enter>, and then select [Yes].

✏️ The above item is accessible only when at least one BIOS profile is available in the BIOS Flash.

Profile Name

Allows you to input a profile name for the current BIOS settings.

Save to Profile

Allows you to save the current BIOS settings to profile. Key in a profile number from 1 to 8 to save the settings to the corresponding profile, press <Enter>, then select [Yes].

Load/Save Profile from/to USB Drive.

Allows you to load BIOS settings from or save the current BIOS settings to a USB drive installed on your motherboard.

- Select the file of the BIOS settings you wish to load to your system from your USB drive, press <Enter>, and then select [Yes] to start loading.

- Select a USB drive or a folder you wish to save the current BIOS settings to, press <CTRL> + <F2> if you wish to save the current BIOS settings as a *.txt file or <F2> to save as a *.COM file. Input a profile name, then select [Ok].

ASUS SPD Information

Allows you to view the DRAM SPD information.

DIMM Slot Number

Allows you to select a DIMM slot to display the information of the module currently installed on it. Configuration options: [DIMM_A1] [DIMM_A2] [DIMM_B1] [DIMM_B2]

ASUS Armoury Crate

Download & Install ARMOURY CRATE app

Allows you to enable or disable Armoury Crate download process. The Armoury Crate app can help you manage and download the latest drivers and utilities for your motherboard. Configuration options: [Disabled] [Enabled]

MyASUS

Download & Install MyASUS service & app

Allows you to enable or disable MyASUS download process. MyASUS offers a variety of support features such as helping to troubleshoot issues, optimizing product performance, integrating ASUS software, and recovery drive creation. Configuration options: [Disabled] [Enabled]

11   Exit menu

The Exit menu items allow you to load the optimal default values for the BIOS items, and save or discard your changes to the BIOS items. You can access the EZ Mode from the Exit menu.
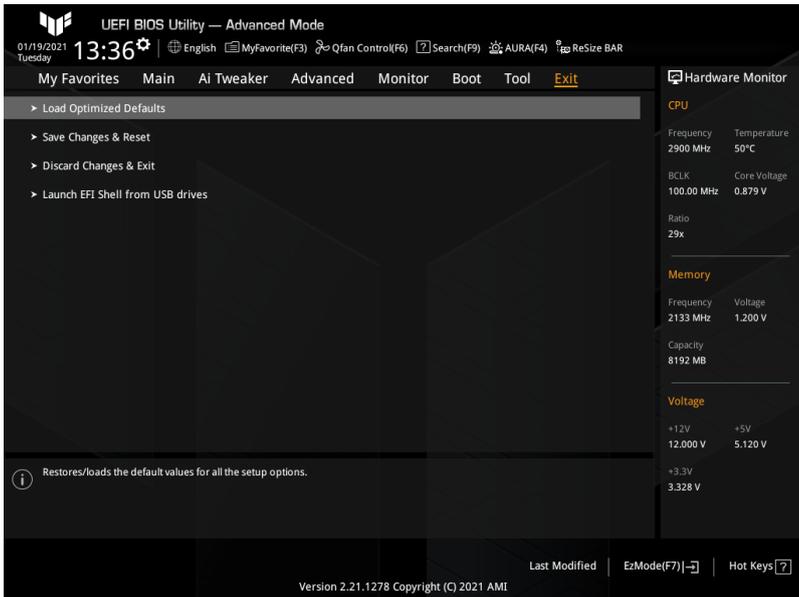
Load Optimized Defaults

This option allows you to load the default values for all the setup options. When you select this option or if you press <F5>, a confirmation window appears. Select [Ok] to load the default values.

Save Changes & Reset

Once you are finished making your selections, choose this option from the Exit menu to ensure the changes you have made are saved. When you select this option or if you press <F10>, a confirmation window appears. Select [Ok] to save changes and exit.

Discard Changes & Exit

This option allows you to exit the Setup program without saving any changes. When you select this option or if you press <Esc>, a confirmation window appears. Select [Ok] to discard changes and exit.

Launch EFI Shell from USB drives

This option allows you to attempt to launch the EFI Shell application (Shell.efi) from one of the available file system devices.

12   Updating BIOS

The ASUS website publishes the latest BIOS versions to provide enhancements on system stability, compatibility,and performance. However, BIOS updating is potentially risky. If there is no problem using the current version of BIOS, DO NOT manually update the BIOS. Inappropriate BIOS updating may result to system's failure to boot. Carefully follow the instructions in this chapter to update your BIOS when necessary.

> Visit http://www.asus.com to download the latest BIOS file for this motherboard.

The following utilities allow you to manage and update the motherboard BIOS Setup program.

1.   EZ Update: Updates the BIOS in Windows® environment.

2.   ASUS EZ Flash 3: Updates the BIOS using a USB flash drive.

3.   ASUS CrashFree BIOS 3: Restores the BIOS using the motherboard support DVD or a USB flash drive when the BIOS file fails or gets corrupted.

12.1   EZ Update

The EZ Update is a utility that allows you to update the motherboard BIOS in Windows® environment.

> •   EZ Update requires an Internet connection either through a network or an ISP (Internet Service Provider).
>
> •   This utility is available in the support DVD that comes with the motherboard package.

12.2 ASUS EZ Flash 3

The ASUS EZ Flash 3 feature allows you to update the BIOS without using an OS-based utility.

Ensure to load the BIOS default settings to ensure system compatibility and stability. Select the **Load Optimized Defaults** item under the **Exit** menu or press hotkey **<F5>**.

To update the BIOS by USB:

- This function can support devices such as a USB flash disk with FAT 32/16 format and single partition only.
- DO NOT shut down or reset the system while updating the BIOS to prevent system boot failure!

1. Insert the USB flash disk that contains the latest BIOS file to the USB port.

2. Enter the Advanced Mode of the BIOS Setup program. Go to the **Tool** menu to select **ASUS EZ Flash 3 Utility** and press <Enter>.

3. Press the Left/Right arrow keys to switch to the **Drive** field.

4. Press the Up/Down arrow keys to find the USB flash disk that contains the latest BIOS, and then press <Enter>.

5. Press the Left/Right arrow keys to switch to the **Folder** field.

6. Press the Up/Down arrow keys to find the BIOS file, and then press <Enter> to perform the BIOS update process. Reboot the system when the update process is done.

12.3   ASUS CrashFree BIOS 3

The ASUS CrashFree BIOS 3 utility is an auto recovery tool that allows you to restore the BIOS file when it fails or gets corrupted during the updating process. You can restore a corrupted BIOS file using a USB flash drive that contains the BIOS file.

Recovering the BIOS

1.   Download the latest BIOS version for this motherboard from https://www.asus.com/support/.

2.   Rename the BIOS file as **ASUS.CAP** or **XXXXX.CAP** and copy the renamed BIOS file to a USB flash drive.

The name of the CAP file varies depending on models. Refer to the user manual that came with your motherboard for the name.

3.   Turn on the system.

4.   Insert the USB flash drive containing the BIOS file to a USB port.

5.   The utility automatically checks the devices for the BIOS file. When found, the utility reads the BIOS file and enters ASUS EZ Flash 3 automatically.

6.   The system requires you to enter BIOS Setup to recover the BIOS setting. To ensure system compatibility and stability, we recommend that you press <F5> to load default BIOS values.

DO NOT shut down or reset the system while updating the BIOS! Doing so can cause system boot failure!